Subject to approval

COMPUTER SCIENCE

SYLLABUS

The syllabus applies to students admitted in the academic year 2019-20 and thereafter under the four-year curriculum.

Definition and Terminology

Each course offered by the Department of Computer Science shall be classified as either introductory level course or advanced level course.

A Discipline Core course is a compulsory course which a candidate must pass in the manner provided for in the Regulations.

A Discipline Elective course refers to any technical course offered by the Department of Computer Science for the fulfillment of the curriculum requirements of the degree of BEng in Computer Science that are not classified as discipline core course.

Curriculum

The Curriculum comprises 240 credits of courses as follows:

Engineering Core Courses
Students are required to complete at least 42 credits of Engineering Core Courses.

Discipline Core Courses
Students are required to complete ALL discipline core courses (54 credits), comprising 24 credits of introductory core courses and 30 credits of advanced core courses.

Discipline Elective Courses
Students are required to complete at least 36 credits of discipline elective courses offered by the Department of Computer Science.

Elective Courses
Students are required to complete 42 credits of elective course(s) offered by either the Department of Computer Science, or other departments within or outside of the Faculty of Engineering.

University Requirements
Students are required to complete:

a) 12 credits in English language enhancement, including 6 credits in "CAES1000 Core University English" and 6 credits in "CAES9542 Technical English for Computer Science";
b) 6 credits in Chinese language enhancement course "CENG9001 Practical Chinese for Engineering Students"; and
c) 36 credits of courses in the Common Core Curriculum, comprising at least one and not more than two courses from each Area of Inquiry with not more than 24 credits of courses being selected within one academic year except where candidates are required to make up for failed credits during the whole period of study.

Capstone Experience

Students are required to complete the 12-credit "COMP4801 Final year project" or "COMP4802 Extended final year project" to fulfill the capstone experience requirement for the degree of BEng in Computer Science.

Internship
Students are required to complete the non-credit bearing internship "COMP3410 Internship", which normally takes place after their third year of study.

Degree Classification

The degree of Bachelor of Engineering shall be awarded in five divisions in accordance with EN 15 of the Regulations for the Degree of Bachelor of Engineering and UG 9 of the Regulations for First Degree Curricula.

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

The curriculum of BEng (Computer Science) comprises 240 credits of courses with the following structure:

UG 5 Requirements (54 credits)

Course Code	Course	No. of credits
CAES1000	Core University English	6
CAES9542	Technical English for Computer Science	6
CENG9001	Practical Chinese for Engineering Students	6
CC##XXXX	University Common Core Course (6 courses)*	36
Total for UG5 Requirements		54

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

Engineering Core Courses (42 credits)

Course Code	Course	No. of credits
MATH1851	Calculus and ordinary differential equations	6
MATH1853	Linear algebra, probability and statistics	6
ENGG1300	Fundamental mechanics	6
ENGG1310	Electricity and electronics	6
ENGG1320	Engineers in the modern world	6
ENGG1330	Computer programming I	6
ENGG1340	Computer programming II	6
Total for Engineering Core Courses		42

Discipline Core Courses (54 credits)

Introductory Courses (24 credits)

Course Code	Course	No. of credits
COMP2119	Introduction to data structures and algorithms	6
COMP2120	Computer organization	6
COMP2121	Discrete mathematics	6
COMP2396	Object-oriented programming and Java	6

Total for Introductory Discipline Core Courses	24

Advanced Courses (30 credits)

Course Code	Course	No. of credits
COMP3230	Principles of operating systems	6
COMP3234	Computer and communication networks	6
COMP3250	Design and analysis of algorithms	6
COMP3278	Introduction to database management systems	6
COMP3297	Software engineering	6
Total for Advanced Discipline Core Courses		30

Capstone Experience and Internship (12 credits)

Course Code	Course	No. of credits
COMP3410	Internship*	0
COMP4801 / COMP4802	Final year project[+] / Extended final year project[+]	12
Total for Capstone Experience and Internship		12

[+]Capstone Experience
*Internship
*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 COMP3412 Internship.

Discipline Elective Courses (36 credits)

Course Code	Course	No. of credits
COMP3231	Computer architecture	6
COMP3235	Compiling techniques	6
COMP3258	Functional programming	6
COMP3259	Principles of programming languages	6
COMP3270	Artificial intelligence	6
COMP3271	Computer graphics	6
COMP3311	Legal aspects of computing	6
COMP3314	Machine learning	6
COMP3316	Quantum information and computation	6
COMP3317	Computer vision	6
COMP3320	Electronic commerce technology	6
COMP3322	Modern technologies on World Wide Web	6
COMP3323	Advanced database systems	6
COMP3329	Computer game design and programming	6
COMP3330	Interactive mobile application design and programming	6
COMP3351	Advanced algorithm analysis	6
COMP3352	Algorithmic game theory	6
COMP3353	Bioinformatics	6
COMP3354	Statistical learning	6
COMP3355	Cyber security	6
COMP3356	Robotics	6

COMP3357	Cryptography	6
COMP3358	Distributed and parallel computing	6
COMP3359	Artificial intelligence applications	6
COMP3403	Implementation, testing and maintenance of software systems	6
COMP3404	Software quality and project management	6
COMP3407	Scientific computing	6
COMP3413	Research internship	6
COMP3414	Experiential learning on artificial intelligence and robotics	6
Complete at least six discipline elective courses for a total of 36 credits		36

Elective Courses (42 credits)

At least 42 credits of courses offered by either the Department of Computer Science, or other departments within or outside of the Faculty of Engineering.

Elective MSc(CompSc) courses

Students may take up to two 6-credit MSc(CompSc) courses offered by the Department of Computer Science as elective courses, subject to the approval of the Head of the Department.

Summary of curriculum structure of BEng (Computer Science)

Course Categories	No. of credits
UG5 Requirements	54
Engineering Core Courses	42
Discipline Core Courses (Introductory)	24
Discipline Core Courses (Advanced)	30
Capstone Experience and Internship	12
Discipline Elective Courses	36
Elective Courses	42
Total	**240**

A sample study plan is given as follows:

FIRST YEAR

Engineering Core Courses (42 credits)

MATH1851	Calculus and ordinary differential equations	6
MATH1853	Linear algebra, probability and statistics	6
ENGG1300	Fundamental mechanics	6
ENGG1310	Electricity and electronics	6
ENGG1320	Engineers in the modern world	6
ENGG1330	Computer programming I	6
ENGG1340	Computer programming II	6

University Requirements (UG5) (18 credits)

CAES1000	Core University English	6
CC##XXXX	Two Common Core Courses	12

SECOND YEAR

Introductory Discipline Core Courses (24 credits)

COMP2119	Introduction to data structures and algorithms	6
COMP2120	Computer organization	6
COMP2121	Discrete mathematics	6
COMP2396	Object-oriented programming and Java	6

Discipline Elective Courses (6 credits)

Elective Courses (6 credits)

University Requirements (UG5) (24 credits)

CC##XXXX	Four Common Core Courses	24

THIRD YEAR

Advanced Discipline Core Courses (30 credits)

COMP3230	Principles of operating systems	6
COMP3234	Computer and communication networks	6
COMP3250	Design and analysis of algorithms	6
COMP3278	Introduction to database management systems	6
COMP3297	Software engineering	6

Internship (0 credit)

COMP3410	Internship	0

University Requirements (UG5) (6 credits)

CENG9001	Practical Chinese for Engineering Students (This course should be enrolled in the third year)	6

Discipline Elective Courses (12 credits)

Elective Courses (12 credits)

FOURTH YEAR

Discipline Elective Courses (18 credits)

Capstone Experience (12 credits)

COMP4801	Final year project	12

University Requirements (UG5) (6 credits)

CAES9542	Technical English for Computer Science	6

Elective Courses (24 credits)

MAJOR IN COMPUTER SCIENCE
(for non-BEng(CompSc) students)

The curriculum comprises 84 credits of courses with the following structure:

Prerequisite: Level 3 or above in Mathematics in the Hong Kong Diploma of Secondary Education (HKDSE) Examination, or equivalent

Introductory Courses (30 credits)

Course Code	Course	No. of credits
COMP1117	Computer programming	6
COMP2113	Programming technologies	6
COMP2119	Introduction to data structures and algorithms	6
COMP2120	Computer organization	6
COMP2121	Discrete mathematics	6
Total for Introductory Courses		30

Elective courses (48 credits)

12 credits of courses to be chosen from the following list:

Course Code	Course	No. of credits
COMP3230	Principles of operating systems	6
COMP3234	Computer and communication networks	6
COMP3278	Introduction to database management systems	6
COMP3297	Software engineering	6

36 credits of courses to be chosen from the following lists:

Introductory Courses

Course Code	Course	No. of credits
COMP2396	Object-oriented programming and Java	6

Advanced Courses

Course Code	Course	No. of credits
COMP3230	Principles of operating systems	6
COMP3234	Computer and communication networks	6
COMP3278	Introduction to database management systems	6
COMP3297	Software engineering	6
COMP3231	Computer architecture	6
COMP3235	Compiling techniques	6
COMP3250	Design and analysis of algorithms	6
COMP3258	Functional programming	6
COMP3259	Principles of programming languages	6
COMP3270	Artificial intelligence	6
COMP3271	Computer graphics	6
COMP3311	Legal aspects of computing	6
COMP3314	Machine learning	6
COMP3316	Quantum information and computation	6
COMP3317	Computer vision	6
COMP3320	Electronic commerce technology	6
COMP3322	Modern technologies on World Wide Web	6
COMP3323	Advanced database systems	6
COMP3329	Computer game design and programming	6
COMP3330	Interactive mobile application design and programming	6

COMP3351	Advanced algorithm analysis	6
COMP3352	Algorithmic game theory	6
COMP3353	Bioinformatics	6
COMP3354	Statistical learning	6
COMP3355	Cyber security	6
COMP3356	Robotics	6
COMP3357	Cryptography	6
COMP3358	Distributed and parallel computing	6
COMP3359	Artificial intelligence applications	6
COMP3403	Implementation, testing and maintenance of software systems	6
COMP3404	Software quality and project management	6
COMP3407	Scientific computing	6
Total for Advanced Courses		48

Capstone Experience (6 credits to be chosen from the following list)

Course Code	Course	No. of credits
COMP4805	Project	6
COMP3297	Software engineering*	6
Total for Capstone Experience		6

*If students choose to complete "COMP3297 Software engineering" for fulfilling the requirement of capstone experience, COMP3297 will not be counted towards the category of Elective Courses.

Notes:

1. In principle, double counting is not permissible.
   - 1.1 BEng students who have completed ENGG1330 are deemed to have completed COMP1117, they are not permitted to take COMP1117 and are required to complete one more elective in Computer Science as replacement.
   - 1.2 BEng students who have completed ENGG1340 are deemed to have completed COMP2113, they are not permitted to take COMP2113 and are required to complete one more elective in Computer Science as replacement.
   - 1.3 Non-BEng students who have completed COMP1117 to fulfil the requirement of their primary major are required to complete one more elective in Computer Science.
   - 1.4 Students who have completed MATH3600 Discrete mathematics are deemed to have completed COMP2121, they are not permitted to take COMP2121 and are required to complete one more elective in Computer Science as replacement.
2. Course enrollment in elective courses is subject to the approval of the Department of Computer Science, in consideration of class quota and other academic issues.

MINOR IN COMPUTER SCIENCE
(This minor option is not available for BEng(CE) and BEng(CompSc) students)

The curriculum comprises 42 credits of courses with the following structure, in which students are required to complete 18 credits of Core Courses and 24 credits of Elective Courses.

Prerequisite: Level 3 or above in Mathematics in the Hong Kong Diploma of Secondary Education (HKDSE) Examination, or equivalent

Core Courses (18 credits)

Introductory Courses

Course Code	Course	No. of credits
COMP1117	Computer programming	6
COMP2113	Programming technologies	6
COMP2119	Introduction to data structures and algorithms	6
Total for Core Courses		18

Elective Courses (24 credits to be chosen from the following lists of Introductory Courses or Advanced Courses)

Introductory Courses

Course Code	Course	No. of credits
COMP2120	Computer organization	6
COMP2121	Discrete mathematics	6
COMP2396	Object-oriented programming and Java	6

Advanced Courses

Course Code	Course	No. of credits
COMP3230	Principles of operating systems	6
COMP3231	Computer architecture	6
COMP3234	Computer and communication networks	6
COMP3235	Compiling techniques	6
COMP3250	Design and analysis of algorithms	6
COMP3258	Functional programming	6
COMP3259	Principles of programming languages	6
COMP3270	Artificial intelligence	6
COMP3271	Computer graphics	6
COMP3278	Introduction to database management systems	6
COMP3297	Software engineering	6
COMP3311	Legal aspects of computing	6
COMP3314	Machine learning	6
COMP3316	Quantum information and computation	6
COMP3317	Computer vision	6
COMP3320	Electronic commerce technology	6
COMP3322	Modern technologies on World Wide Web	6
COMP3323	Advanced database systems	6
COMP3329	Computer game design and programming	6
COMP3330	Interactive mobile application design and programming	6
COMP3351	Advanced algorithm analysis	6
COMP3352	Algorithmic game theory	6
COMP3353	Bioinformatics	6
COMP3354	Statistical learning	6
COMP3355	Cyber security	6

COMP3356	Robotics	6
COMP3357	Cryptography	6
COMP3358	Distributed and parallel computing	6
COMP3359	Artificial intelligence applications	6
COMP3403	Implementation, testing and maintenance of software systems	6
COMP3404	Software quality and project management	6
COMP3407	Scientific computing	6
Total for Advanced Courses		24

Notes:

1. In principle, double counting is not permissible.

1.1 BEng students who have completed ENGG1330 are deemed to have completed COMP1117, they are not permitted to take COMP1117 and are required to complete one more elective in Computer Science as replacement.

1.2 BEng students who have completed ENGG1340 are deemed to have completed COMP2113, they are not permitted to take COMP2113 and are required to complete one more elective in Computer Science as replacement.

1.3 Non-BEng students who have completed COMP1117 to fulfil the requirement of their primary major are required to complete one more elective in Computer Science.

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

COURSE DESCRIPTIONS

Candidates will be required to do the coursework in the respective courses selected. Not all courses are offered every semester.

Engineering Core Courses

MATH1851 Calculus and ordinary differential equations (6 credits)
MATH1853 Linear algebra, probability and statistics (6 credits)
ENGG1300 Fundamental mechanics (6 credits)
ENGG1310 Electricity and electronics (6 credits)
ENGG1320 Engineers in the modern world (6 credits)
ENGG1330 Computer programming I (6 credits)
ENGG1340 Computer programming II (6 credits)

Please refer to the Engineering Core Courses in the syllabus for the degree of BEng for details.

University Requirements on Language Enhancement Courses

CAES1000. Core University English (6 credits)
CENG9001. Practical Chinese for Engineering Students (6 credits)

Please refer to the University Language Enhancement Courses in the syllabus for the degree of BEng for details.

CAES9542. Technical English for Computer Science (6 credits)

Running alongside Computer Science project based courses, this one semester, 6-credit course will build and consolidate final year CS and Computing and data analytics students' ability to compose technical reports, and make technical oral presentations. The focus of this course is on helping students to report on the progress of their Final Year Project in an effective, professional manner in both written and oral communication. Topics include accessing, abstracting, analyzing, organizing and summarizing information; making effective grammatical and lexical choices; technical report writing; and technical presentations. Assessment is wholly by coursework.

Co-requisite: COMP4801 or COMP4802 or COMP4804
Assessment: 100% continuous assessment.

University Common Core Curriculum

Successful completion of 36 credits of courses in the Common Core Curriculum, comprising at least one and not more than two courses from each Area of Inquiry with not more than 24 credits of courses being selected within one academic year except where candidates are required to make up for failed credits:

- Scientific and Technology Literacy
- Humanities
- Global Issues
- China: Culture, State and Society

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
Assessment: 70% continuous assessment, 30% 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 advanced Python programming, Linux shell commands, shell scripts, separate compilation techniques and C programming. 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
Mutually exclusive with: ENGG1340 or COMP2123
Assessment: 70% continuous assessment, 30% 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: ENGG1340 or COMP2113 or COMP2123
Assessment: 40% continuous assessment, 60% examination

COMP2120. Computer organization (6 credits)

Introduction to computer organization and architecture; data representations; instruction sets; machine and assembly languages; basic logic design and integrated devices; the central processing unit and its control; memory and caches; I/O and storage systems; computer arithmetic.

Co-requisite: COMP1117 or ENGG1111 or ENGG1112 or ENGG1330
Mutually exclusive with: ELEC2441
Assessment: 50% continuous assessment, 50% examination

COMP2121. Discrete mathematics (6 credits)

This course provides students a solid background on discrete mathematics and structures pertinent to computer science. Topics include logic; set theory; mathematical reasoning; counting techniques; discrete probability; trees, graphs, and related algorithms; modeling computation.

Mutually exclusive with: MATH3600
Assessment: 50% continuous assessment, 50% examination

COMP2396. Object-oriented programming and Java (6 credits)

Introduction to object-oriented programming; abstract data types and classes; inheritance and polymorphism; object-oriented program design; Java language and its program development environment; user interfaces and GUI programming; collection class and iteration protocol; program documentation.

Prerequisite: ENGG1340 or COMP2113 or COMP2123
Mutually exclusive with: ELEC2543
Assessment: 50% continuous assessment, 50% examination

COMP3230. Principles of operating systems (6 credits)

Operating system structures, process and thread, CPU scheduling, process synchronization, deadlocks, memory management, file systems, I/O systems and device driver, mass-storage structure and disk scheduling, case studies.

Prerequisites: ENGG1340 or COMP2113 or COMP2123; and COMP2120 or ELEC2441
Assessment: 50% continuous assessment, 50% examination

COMP3231. Computer architecture (6 credits)

Introduction to computer design process; performance and cost analysis; instruction set design; data-path and controller design; pipelining; memory system; I/O design; GPU architecture and programming; introduction to advanced topics.

Prerequisite: COMP2120
Assessment: 40% continuous assessment, 60% examination

COMP3234. Computer and communication networks (6 credits)

Network structure and architecture; reference models; stop and wait protocol; sliding window protocols; character and bit oriented protocols; virtual circuits and datagrams; routing; flow control; congestion control; local area networks; issues and principles of network interconnection; transport protocols and application layer; and examples of network protocols.

Co-requisite: COMP3230
Mutually exclusive with: ELEC3443
Assessment: 50% continuous assessment, 50% examination

COMP3235. Compiling techniques (6 credits)

Lexical analysis; symbol table management; parsing techniques; error detection; error recovery; error diagnostics; run-time memory management; optimization; code generation.

Prerequisite: COMP2119
Assessment: 50% continuous assessment, 50% examination

COMP3250. Design and analysis of algorithms (6 credits)

The course studies various algorithm design techniques, such as divide and conquer, and dynamic programming. These techniques are applied to design novel algorithms from various areas of computer science. Topics include: advanced data structures; graph algorithms; searching algorithms; geometric algorithms; overview of NP-complete problems.

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

COMP3258. Functional programming (6 credits)

The course teaches the basics of functional programming using the language Haskell. The main goal is introduce students to fundamental programming concepts such as recursion, abstraction, lambda expressions and higher-order functions and data types. The course will also study the mathematical reasoning involved in the design of functional programs and techniques for proving properties about functions so defined. With the adoption of lambda expressions recent versions of Java, C++ or C#, functional programming and related programming techniques are becoming increasingly more relevant even for programmers of languages that are not traditionally viewed as functional. This course is important to introduce students to such techniques.

Prerequisite: COMP2121

Assessment: 50% continuous assessment, 50% examination

COMP3259. Principles of programming languages (6 credits)

Syntax and semantics specification; data types; data control and memory management; expressions, precedence and associativity of operators; control structures; comparative study of existing programming languages; advanced topics such as polymorphism, programming paradigms, exception handling and concurrency.

Prerequisites: COMP2119
Assessment: 40% continuous assessment, 60% examination

COMP3270. Artificial intelligence (6 credits)

This is an introduction course on the subject of artificial intelligence. Topics include: intelligent agents; search techniques for problem solving; knowledge representation; logical inference; reasoning under uncertainty; statistical models and machine learning.

Prerequisite: COMP2119
Mutually exclusive with: IIMT3688
Assessment: 50% continuous assessment, 50% examination

COMP3271. Computer graphics (6 credits)

Overview of graphics hardware, basic drawing algorithms, 2-D transformations, windowing and clipping, interactive input devices, curves and surfaces, 3-D transformations and viewing, hidden-surface and hidden-line removal, shading and colour models, modelling, illumination models, image synthesis, computer animation.

Prerequisite: COMP2119
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 ELEC2543
Mutually exclusive with: IIMT3601
Assessment: 50% continuous assessment, 50% examination

COMP3297. Software engineering (6 credits)

This course introduces the fundamental principles and methodologies of software engineering. It covers the software process, and methods and tools employed in the modern software development, with focus on the analysis, design, implementation and testing of contemporary object-oriented systems. The use of the UML and contemporary frameworks are emphasized. The course includes a team-based project

in which students apply their new knowledge to a full lifecycle of iterative and incremental development.

Prerequisite: ENGG1340 or COMP2113 or COMP2123
Mutually exclusive with: IIMT3602
Assessment: 50% continuous assessment, 50% examination

COMP3311. Legal aspects of computing (6 credits)

To introduce students to the laws affecting computing and the legal issues arising from the technology. Contents include: the legal system of Hong Kong; copyright protection for computer programs; intellectual property issues on the Internet; data privacy; computer-related crimes; codes of professional conduct for computer professionals.

Prerequisite: ENGG1340 or COMP2113 or COMP2123
Assessment: 30% continuous assessment, 70% examination

COMP3314. Machine learning (6 credits)

This course introduces algorithms, tools, practices, and applications of machine learning. Topics include core methods such as supervised learning (classification and regression), unsupervised learning (clustering, principal component analysis), Bayesian estimation, neural networks; common practices in data pre-processing, hyper-parameter tuning, and model evaluation; tools/libraries/APIs such as scikit-learn, Theano/Keras, and multi/many-core CPU/GPU programming.

Prerequisite: MATH1853 or MATH2101; and COMP2119 or ELEC2543
Assessment: 50% continuous assessment, 50% examination

COMP3316. Quantum information and computation (6 credits)

This course offers a gentle introduction to the interdisciplinary field of quantum information and computation. We will start from the basic principles of quantum theory and become familiar with the counterintuitive notions of quantum superposition and entanglement. Once the basics have been covered, we will explore the cornerstones of quantum information theory: quantum cloning machines, quantum teleportation, quantum state discrimination, quantum error correction, quantum cryptography and data compression. Finally, we will provide an overview of quantum computation and of the main quantum algorithms, including Shor’s algorithm for prime factorization in polynomial time and Grover's quantum search algorithm.

Prerequisite: MATH1853 or MATH2101 or equivalent (e.g., PHYS2155)
Assessment: 50% continuous assignment, 50% examination

COMP3317. Computer vision (6 credits)

This course introduces the principles, mathematical models and applications of computer vision. Topics include: image processing techniques, feature extraction techniques, imaging models and camera calibration techniques, stereo vision, and motion analysis.

Prerequisite: COMP2119; and MATH1853 or MATH2101
Assessment: 50% continuous assessment, 50% examination

COMP3320. Electronic commerce technology (6 credits)

This course aims to help students to understand the technical and managerial challenges they will face as electronic commerce becomes a new locus of economics activities. Topics include Internet and WWW technology, information security technologies, public-key crypto-systems, public-key infrastructure, electronic payment systems, and electronic commerce activities in different sectors.

Prerequisite: COMP3278
Assessment: 50% continuous assessment, 50% examination

COMP3322. Modern technologies on World Wide Web (6 credits)

Selected network protocols relevant to the World Wide Web (e.g., HTTP, DNS, IP); World Wide Web; technologies for programming the Web (e.g, HTML, XML, style sheets, PHP, JavaScript, Node.js.; other topics of current interest (AJAX, HTML5, web services, cloud computing).

Prerequisite: COMP1117 or ENGG1330 or ENGG1111 or ENGG1112
Mutually exclusive with: IIMT3663
Assessment: 60% continuous assessment, 40% 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
Assessment: 50% continuous assessment, 50% examination

COMP3329. Computer game design and programming (6 credits)

This course introduces the concepts and techniques for computer game design and development. Topics include: game history and genres, game design process, game engine, audio and visual design, 2D and 3D graphics, physics, optimization, camera, network, artificial intelligence and user interface design. Students participate in group projects to gain hands-on experience in using common game engine in the market.

Prerequisite: ENGG1340 or COMP2113 or COMP2123
Assessment: 50% continuous assessment, 50% examination

COMP3330. Interactive mobile application design and programming (6 credits)

This course introduces the techniques for developing interactive mobile applications on Android platform. Topics include user interface design, graphics, parallel computing, database, network, multimedia, sensors and location service. Trends and tools for developing applications on various mobile platforms are also discussed. Students participate in both individual assignments and group projects to practice ideation, reading, writing, coding and presentation skills.

Prerequisite: COMP2396
Assessment: Assessment: 70% continuous assessment, 30% examination

---

COMP3351. Advanced algorithm analysis (6 credits)

This class introduces advanced mathematical techniques for analyzing the complexity and correctness of algorithms. NP-complete problems are believed to be not solvable in polynomial time and we study how approximation algorithms could give near optimal solutions. In particular, we will see that probability theory gives us a very powerful tool to tackle problems that are otherwise hard to solve.

Prerequisite: COMP3250; or basic knowledge in probability and algorithms
Assessment: 50% continuous assessment, 50% examination

COMP3352. Algorithmic game theory (6 credits)

Strategic behaviors of users are of increasingly importance in today's computational problems, from data analysis (where a user may manipulate his data) to routing (where a user may strategically choose a path instead of the one that the algorithm specifies). This is an undergraduate advanced algorithm course that covers various topics at the interface of theoretical computer science and economics, seeking to provide the basic concepts and techniques, both economic and algorithmic ones, that would allow to students to design algorithms that achieve the desirable outcomes in the presence of strategic behaviors of users.

This course focuses on three topics: 1) mechanism design, a study on incentivizing users to truthfully report their data for a given computational task; 2) price of anarchy in games, a systematic approach to quantify the inefficiency caused by users' strategic behaviors; and 3) algorithms and complexity theory for learning and computing Nash and market equilibria. The course will also cover some selected advanced topics such as the use of data of past user behaviors in auction design, and case studies of some important applications including online advertisement auctions and kidney exchange market.

Prerequisite: MATH1853 or MATH2101; and COMP2119
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: COMP2119
Assessment: 70% continuous assessment, 30% examination

COMP3354. Statistical learning (6 credits)

The challenges in learning from big and complicated data have led to significant advancements in the statistical sciences. This course introduces supervised and unsupervised learning, with emphases on

the theoretical underpinnings and on applications in the statistical programming environment R. Topics include linear methods for regression and classification, model selection, model averaging, basic expansions and regularization, kernel smoothing methods, additive models and tree-based methods. We will also provide an overview of neural networks and random forests.

Prerequisite: MATH1853 or MATH2101 or STAT1602 or STAT1603
Assessment: 50% continuous assessment, 50% 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).

Prerequisites: COMP2119 or ELEC2543
Mutually exclusive with: ELEC4641
Assessment: 50% continuous assessment, 50% examination

COMP3356. Robotics (6 credits)

This course provides an introduction to mathematics and algorithms underneath state-of-the-art robotic systems. The majority of these techniques are heavily based on probabilistic reasoning and optimization – two areas with wide applicability in modern AI. We will also cover some basic knowledge about robotics, namely geometry, kinematics, dynamics, control of a robot, as well as the mathematical tools required to describe the spatial motion of a robot will be presented. In addition, we will cover perception, planning, and learning for a robotic system, with the obstacle avoidance and robotic arm manipulation as typical examples.

Pre-requisites: MATH1853 or MATH2014; and COMP2121 or STAT2601; and COMP2119
Assessment: 50% continuous assessment, 50% examination

COMP3357. Cryptography (6 credits)

This course offers a gentle introduction to the field of cryptography. We will start from the basic principles of confidentiality, integrity and authentication. After that, we will go through some fundamental cryptographic primitives like hash function, symmetric key encryption, public key encryption and digital signatures. Finally, we will introduce the basics of quantum cryptography including quantum key distribution and random number generation.

Pre-requisites: MATH1853 or MATH2101 or equivalent (e.g., PHYS2155)
Assessment: 50% continuous assessment, 50% examination

COMP3358. Distributed and parallel computing (6 credits)

This course introduces the basic concepts and modern software architectures on distributed and parallel computing. Topics include: computer network primitives, distributed transactions and two-phase commits, webservices, parallelism and scalability models, distributed consistency models, distributed

fault-tolerance, actor and monads, Facebook photo cache, Amazon key-value stores, Google Map-reduce, Spark, and TensorFlow.

Pre-requisites: COMP3230 or COMP3234
Assessment: 50% continuous assessment, 50% examination

COMP3359. Artificial intelligence applications (6 credits)

This course focuses on practical applications of AI technologies. The course comprises two main components: students first acquire the knowledge and know-how of the state-of-the-art AI technologies, platforms and tools (e.g., TensorFlow, PyTorch, Open AI, scikit-learn, Azure AI) via self-learning of designated materials including open courseware. Students will then explore practical AI applications and complete a course project which implements an AI-powered solution to a problem of their own choice.

Pre-requisites: ENGG1340 or COMP2113
Assessment: 70% continuous assessment, 30% examination

COMP3403. Implementation, testing and maintenance of software systems (6 credits)

This course examines the theory and practice of software implementation, testing and maintenance. Topics in implementation include: detailed design issues and implementation strategies; coding style and standards; the review process; pattern implementation and reuse. Testing covers strategies and techniques for unit and component testing; integration testing; system, performance and acceptance testing; test documentation and test management. Topics in maintenance include maintenance techniques, tools and metrics; software rejuvenation; and refactoring.

Prerequisite: COMP3297 or IIMT3602
Co-requisite: COMP2396
Assessment: 50% continuous assessment, 50% examination

COMP3404. Software quality and project management (6 credits)

Topics in software quality include: software quality models; quality assurance; software quality metrics; quality reviews, inspections and audits. Topics in project management include: project planning, cost estimation and scheduling; project monitoring and control; agile, traditional and extreme process models and their management; risk analysis; configuration management and control; software acquisition; contract management; and process improvement.

Prerequisite: COMP3297
Mutually exclusive with: IIMT4601
Assessment: 50% continuous assessment, 50% examination

COMP3407. Scientific computing (6 credits)

This course provides an overview and covers the fundamentals of scientific and numerical computing. Topics include numerical analysis and computation, symbolic computation, scientific visualization, architectures for scientific computing, and applications of scientific computing.

Prerequisites: COMP1117 or ENGG1330 or ENGG1111 or ENGG1112; and COMP2121
Assessment: 50% continuous assessment, 50% examination

COMP3410. Internship (0 credit) *[for intakes of 2018 and thereafter]*

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 computer 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 computing and to evaluate proposed answers to those questions. Topics include: intellectual property, privacy, social context of computing, risks, safety and security concerns for computer professionals, professional and ethical responsibilities, and continuing professional development.

Assessment: 100% continuous assessment

COMP3412. Internship (6 credits) *[for intakes of 2012 to 2017 (4-year curriculum)]*

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 computer 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 computing and to evaluate proposed answers to those questions. Topics include social context of computing, risks, safety and security concerns for computer professionals, professional and ethical responsibilities, and continuing professional development.

Assessment: 100% continuous assessment

COMP3413. Research internship (6 credits)

The student will participate in a research project under the guidance and supervision of a teacher over a prescribed period of time; the results will be presented in an oral and a written report.

Assessment: 100% continuous assessment

COMP3414. Experiential learning on artificial intelligence and robotics (6 credits)

This is a multidisciplinary experiential learning course designed for engineering students to learn about artificial intelligence (AI) and robotics. Students will learn AI and robot related technical disciplines (such as machine vision, embedded system design, mechanical control, inertial navigation, human-computer interaction, etc.) through designing and building intelligent robots, and forming teams to participate in robotics competitions such as RoboMaster Robotics Competition and AI Driving Olympics (AI-DO), etc.

Assessment: 100% continuous assessment

COMP4801. Final year project (12 credits)

Student individuals or groups, during the final year of their studies, undertake full end-to-end development of a substantial project, taking it from initial concept through to final delivery. Topics range from applied software development to assignments on basic research. In case of a team project, significant contribution is required from each member and students are assessed individually, such that each student is given a separate project title. Strict standards of quality will be enforced throughout the project development.

Assessment: 100% continuous assessment

COMP4802. Extended final year project (12 credits)

In this 3-semester capstone project, students will work individually or in groups on a self-proposed project. Students are required to initiate project ideas, devise feasible solutions, and complete a final deliverable. Project ideas should integrate students' knowledge and skills on computing and may include, but not limited to innovations and practical solutions to everyday problems. Starting from the second semester of their third year studies, students will engage in brainstorming activities for idea incubation; they will also submit initial project proposals for approval by end of the third year. Students will then work intensively, under the guidance of a teacher, on the development and implementation of the project deliverables throughout the final year of their studies.

Assessment: 100% continuous assessment

COMP4804. Computing and data analytics project (6 credits)
[for candidates pursuing the degree BEng(EngSc) – Computing and Data Analytics]

Students during the final year of their studies undertake a substantial project, taking it from initial concept through to final delivery, and integrating their knowledge and skills on computing and data analytics.

Assessment: 100% continuous assessment

COMP4805. Project (6 credits)
[for non-BEng(CompSc) candidates pursuing Computer Science as second major]

Students during the final year of their studies undertake a substantial project, taking it from initial concept through to final delivery, and integrating their knowledge and skills on computing.

Assessment: 100% continuous assessment
