DEPARTMENT OF COMPUTER SCIENCE

- **Undergraduate Courses**
- **Postgraduate Courses**

COMP 101   Exploring Multimedia and Internet Computing   [2-0-2:3]
Interesting and useful things you can do on the computer, but take time to learn. Introduction to multimedia and internet computing tools. Internet, e-mail, WWW, webpage design, computer animation, spreadsheet charts/figures, presentations with graphics and animations, etc. Business, security, accessibility, and relevant IP right issues in the use of computers. *Exclusions*: ISMT 101, ISMT 102 (prior to 2004-05)

COMP 002   Academic and Professional Development II   [0 credit]
Continuation of COMP 001. A compulsory, one year course for Computer Science students. Graded P or F.

COMP 003   Academic and Professional Development III   [0 credit]
Continuation of COMP 002. A compulsory, one year course for Computer Science students. Graded P or F.

COMP 099   Industrial Training   [0 credit]
For Computer Science students only. A practical training course for a period of four to five weeks. Topics may include basic computer architecture and maintenance, UNIX system and network administration, Windows server implementation and administration, and safety. Graded P or F.

COMP 101   Exploring Multimedia and Internet Computing   [2-0-2:3]
Interesting and useful things you can do on the computer, but take time to learn. Introduction to multimedia and internet computing tools. Internet, e-mail, WWW, webpage design, computer animation, spreadsheet charts/figures, presentations with graphics and animations, etc. Business, security, accessibility, and relevant IP right issues in the use of computers. *Exclusions*: ISMT 101, ISMT 102 (prior to 2004-05)

COMP 102   Computer and Programming Fundamentals I   [3-0-2:3]
Introduction to computers and programming. Computer hardware and software. Problem solving. Program design. Procedural abstraction. Debugging and testing. Simple and structured data types. Recursive programming. Introduction to searching and sorting. *Exclusions*: COMP 104/104H, COMP 105 (prior to 98-99), ISMT 103

COMP 103   Computer and Programming Fundamentals II   [2-0-1:2]
Programming techniques and introduction to object-oriented programming. Classes and objects. Data encapsulation and information hiding. Abstract data types. Pointers and linked data structures. Recursive data structures. Searching and sorting. *Exclusions*: COMP 104/104H, ISMT 103, ISMT 223 *Prerequisite*: COMP 102 or COMP 105 (prior to 98-99)

COMP 104   Programming Fundamentals and Methodology   [3-1-2:4]
Structured programming and introduction to object-oriented programming. Problem solving. Program design. Procedural abstraction. Debugging and testing. Classes, objects, and dynamic objects. Abstract data types. Linked data structures. Searching, sorting, and recursive programming. *Exclusions*: COMP 102, COMP 103, COMP 104H, COMP 105 (prior to 98-99), ISMT 103, ISMT 223

COMP 104H Programming Fundamentals and Methodology   [2-1-1:4]
                (Honors Study Track)
Structured programming and introduction to object-oriented programming. Problem solving. Program design. Procedural abstraction. Debugging and testing. Classes, objects, and dynamic objects. Abstract data types. Linked data structures. Searching, sorting, and recursive programming. This is a half-semester course. Enrollment in the course requires approval of the course instructor. *Exclusions*: COMP 102, COMP 103, COMP 104, ISMT 103, ISMT 223 *Prerequisite*: Grade B or above in three HKALE AL subjects

COMP 105   Exploring Music: Music Technology and Creation   [2-0-2:3]
An introductory and interdisciplinary approach to learning music by designing and building simple musical instruments. This course will combine music science, software tools and creativity to introduce students to the fundamentals of music with their active participation. Students will learn about instruments from around the world and how to write a short song or composition for the instruments they build. They will use computer tools to record, edit and sequence sounds, analyze the characteristics of different sound colors, and notate their compositions. No previous musical background required.

COMP 111   Software Tools   [2-0-2:3]
Using, primarily, the UNIX environment and shell programming techniques as a platform for developing software tools. Laboratory exercises will also give hands-on practice with tools that increase programmer productivity such as document preparation tools, window managers and Internet facilities. *Prerequisite*: COMP 102, COMP 104/104H, HKALE Computer Studies or HKCEE Computer Studies

COMP 151   Object-Oriented Programming   [3-0-2:3]
To learn the fundamental concepts and techniques behind object-oriented programming in C++. They include: abstract data types (classes, objects, and methods); creation, initialization, and destruction of objects; class hierarchies and inheritance; polymorphism and dynamic binding. In addition, generic programming using templates and algorithm abstraction will also be discussed. *Exclusion*: COMP 251 (prior to 1999-2000) *Prerequisite*: COMP 103, COMP 104/104H

COMP 171   Data Structures and Algorithms   [3-2-0:3]
Asymptotic notations. Performance measurement. Sorting and searching: algorithms and lower bound. Abstract data types and classes. Data structures: heaps, search trees, tries, and hashing. Graphs: representation, depth-first-search, and breadth-first-search. *Exclusions*: COMP 171H, ISMT 227 (prior to 2000-01) *Prerequisite*: COMP 103, COMP 104/104H

COMP 171H Data Structures and Algorithms (Honors Study Track)   [2-1-0:3]
Asymptotic notations. Performance measurement. Sorting and searching: algorithms and lower bound. Abstract data types and classes. Data structures: heaps, search trees, tries, and hashing. Graphs: representation, depth-first-search, and breadth-first search. This is a half-semester course. Enrollment in the course requires approval of the course instructor. *Exclusions*: COMP 171, ISMT 227 (prior to 2000-01) *Prerequisite*: COMP 104H

COMP 180   Computer Organization   [3-0-1:3]
Inner workings of modern digital computer systems and tradeoffs at the hardware-software interface. Topics include: instructions set design, memory systems, input-output systems, interrupts and exceptions, pipelining, performance and cost analysis, assembly language programming, and a survey of advanced architectures. *Exclusion*: ELEC 152 *Prerequisite*: COMP 102, COMP 104/104H

COMP 190   Directed Studies I (Honors Study Track)   [1-3 credit(s)]
Studies under the directed guidance of a faculty member on a computer science topic at 100-level. A written report and/or an examination are required. Enrollment in the course requires approval of the course instructor. Courses may last for two semesters, depending on the topic and scope of study. *Prerequisite*: Grade B or above in three HKALE AL subjects or a CGA at A- or above

COMP 201   Java Programming   [3-0-1:3]
Introduction to Java programming. Fundamentals include language syntax, object-oriented programming, inheritance, polymorphism, exception handling, multithreading. Standard libraries for input/output, graphics programming, built-in data structures. Application programming interface and foundation class library. *Exclusion*: ISMT 232 *Prerequisite*: COMP 151 or COMP 251 (prior to 1999-2000)

COMP 211   Introduction to Software Engineering   [3-1-1:4]
Methods and tools for planning, designing, implementing, validating, and maintaining large software systems. Project work to build a software system as a team, using appropriate software engineering tools and techniques. *Exclusion*: ISMT 221 *Prerequisites*: COMP 151 and COMP 171/171H

COMP 221   Fundamentals of Artificial Intelligence   [3-1-0:3]
Foundations underlying design of intelligent systems. Relations between logical, statistical, cognitive, biological paradigms; basic techniques for heuristic search, theorem proving, knowledge representation, adaptation; applications in vision, language, planning, expert systems. *Prerequisite*: COMP 171/171H

COMP 231   Database Management Systems   [3-1-1:3]
Principles of database systems; conceptual modeling and data models; logical and physical database design; query languages and query processing; database services including concurrency, crash recovery, security and integrity. Hands-on DBMS experience. *Exclusions*: IEEM 230, ISMT 226 *Prerequisite*: COMP 171/171H

COMP 251   Principles of Programming Languages   [3-0-1:3]
Comparative studies of programming languages, programming language concepts and constructs. Non-imperative programming paradigms: object-oriented, functional, logic, concurrent programming. Basic concepts of program translation and interpretation. Storage allocation and run-time organization. *Prerequisites*: COMP 151 and COMP 171/171H

COMP 252   Principles of Systems Software   [3-0-2:3]
Principles, purpose and organization of systems software; processes, tasks, scheduling, interprocess communication, synchronization, mutual exclusion; memory management; device management; file systems, security and protection, multi-CPU systems, computer networking and distributed computing. *Prerequisites*: COMP 180/ELEC 152; and one of COMP 102, COMP 103, COMP 104/104H

COMP 271   Design and Analysis of Algorithms   [3-1-0:3]
Time and space complexity analysis of algorithms. Design paradigms: divide-and-conquer, greedy algorithms, dynamic programming. Graph algorithms: searching and backtracking, connectivity, biconnectivity, minimum spanning tree, shortest path. NP-completeness. *Prerequisite*: COMP 171/171H

COMP 272   Theory of Computation   [3-1-0:3]
Introduction to automata, formal languages, and computability. Set theory and countability. Finite automata and regular languages. Push-down automata and context-free languages. Turing machines. Church's thesis. Halting problem. Uncomputability. *Prerequisites*: COMP 171/171H, MATH 111/113/152, and MATH 132

COMP 290   Directed Studies II (Honors Study Track)   [1-3 credit(s)]
Studies under the directed guidance of a faculty member on a computer science topic at 200-level. A written report and/or an examination are required. Enrollment in the course requires approval of the course instructor. Courses may last for two semesters, depending on the topic and scope of study. *Prerequisite*: CGA at grade A- or above

COMP 300   Special Topics in Computer Science   [1-4 credit(s)]
Selected topics of current interest to the Department not covered by existing courses. Offerings are announced each semester.

COMP 303   Internet Computing   [2-0-2:3]
Technologies and standards for World Wide Web (WWW), user interfaces and Browsers, authoring tools, Internet protocols, Internet servers, database connectivity, Robots, Search engines, server-side programming, client-side programming, security and privacy, recent advances. *Prerequisite*: COMP 271

COMP 327   Introduction to Pattern Recognition   [3-1-0:3]
Fundamentals of pattern recognition. Bayes decision theory. Parametric and non-parametric classifiers. Feature extraction and selection techniques. Pattern recognition applications. Project work to build a pattern recognition system. *Prerequisites*: COMP 171/171H and MATH 241/244/246

COMP 332   Principles of Database Design   [3-1-0:3]
Data modeling concepts; conceptual, logical and physical design; analyzing, evaluating and improving schemas; schema documentation and maintenance; functional analysis; design tools; schema mappings; database tuning; distributed database design. *Exclusion*: ISMT 226 *Prerequisite*: COMP 231

COMP 334   Distributed Database Systems   [3-0-1:3]
Distributed database system concepts: system architectures; database design and administration; query processing and optimization; transaction management; concurrency control; availability; recovery. A course project using a commerical distributed DBMS is required. *Prerequisite*: COMP 231

COMP 336   Information Retrieval and Search Engines   [3-0-1:3]
Systems that provide relevance (similarity) based retrieval rather than exact matching. Topics: IR system architecture, IR models, performance, evaluation, relevance feedback, clustering, other reduction indexing approaches, analysis applications, future trends. *Prerequisite*: COMP 271

COMP 341   Computer Graphics   [3-0-1:3]
Display technologies; scan conversion; clipping; affine transformations; homogeneous coordinates and projection; viewing transformations; hidden surface removal; reflectance and shading models; ray tracing; spline curves and surfaces; hierarchical modeling; texture mapping; color models. *Prerequisite*: COMP 271

COMP 342   Introduction to Computer Music   [3-0-1:3]
An introductory course in the technology of computer music. Music representation, music theory, musical acoustics, spectral analysis, sound synthesis techniques, sound modification techniques and effects. No previous musical background required, but helpful. *Prerequisite*: COMP 171/171H or ISMT 227 (prior to 2000-01)

COMP 343   Multimedia Computing   [3-0-1:3]
Color theory; digital audio, image and video fundamentals, representation, storage, and processing; digital multimedia applications and programming. *Exclusion*: ELEC 360 *Prerequisite*: COMP 271

COMP 355   Embedded Systems Software   [3-0-2:3]
Principles of software design and implementation for embedded systems; Timing, power, size and mobility constraints in embedded software design; basic hardware concepts; interrupts and interrupt handling; embedded operating system issues; real-time scheduling; real-time operating systems; embedded software development; integrated design environments; embedded networking; formal design methodologies, design examples. *Prerequisites*: COMP 180/ELEC 152, and COMP 252

COMP 361   Computer Communication Networks I   [3-0-1:3]
Principles of computer network architectures and communication protocols; the OSI reference model; switching and multiplexing techniques; data link, network, transport and application layers; LAN and medium access protocols; network programming. *Background*: Probability and statistics *Exclusions*: ELEC 315, ISMT 235 *Prerequisite*: COMP 252

COMP 362   Computer Communication Networks II   [3-0-1:3]
Multimedia requirements; bridges and their spanning tree protocol; advanced internet protocols (IPv6, Diffserv, IntServ, etc.); congestion control and QoS; multicast and broadcast algorithms; network performance and programming; introduction to network security. *Exclusion*: COMP 561 *Prerequisite*: COMP 361 or ELEC 315

COMP 364   Computer and Communication Security   [3-0-0:3]
Cryptosystems, symmetric-key and public-key cryptography, cryptanalysis, authentication, message digests, digital signatures, and random number generation. Access controls and firewalls. Applications such as certificate authorities, electronic commerce, smartcards, and digital cash. *Prerequisite*: COMP 271

COMP 381   Design and Analysis of Computer Architectures   [3-1-0:3]
Analysis, synthesis and evaluation of different computer architectures. Emphasis on computer design with respect to price/performance and its relation to architectural choices such as pipelining, memory hierarchy, input/output, instruction set design, vector processing, and multiprocessing. *Prerequisite*: COMP 252

COMP 382   Introduction to Parallel Computing   [3-0-0:3]
Concept of high-performance computing using parallel and distributed processing. Design, algorithms, applications, and programming of parallel systems such as the Intel Paragon and network of workstations. *Background*: Programming experience and knowledge of computer architecture. *Prerequisites*: COMP 171/171H, and COMP 180/ ELEC 152

COMP 390   Directed Studies III (Honors Study Track)   [1-3 credit(s)]
Studies under the directed guidance of a faculty member on a computer science topic at 300-level. A written report and/or an examination are required. Enrollment in the course requires approval of the course instructor. Courses may last for two semesters, depending on the topic and scope of study. *Prerequisite*: CGA at grade A- or above

COMP 394   Computer Engineering Project I   [0-0-6:2]
[Also ELEC 394] Each Computer Engineering student is required to take COMP/ELEC 394, 395 and 396. The project is conducted under the supervision of a Computer Science and/or Electrical and Electronic Engineering faculty member. May be graded PP.

COMP 395   Computer Engineering Project II   [0-0-9:3]
[Also ELEC 395] Continuation of COMP 394. May be graded PP. *Prerequisite*: COMP 394

COMP 396   Computer Engineering Project III   [0-0-9:3]
[Also ELEC 396] Continuation of COMP 395. *Prerequisite*: COMP 395

COMP 397   Final Year Project I   [0-0-9:3]
A project in an area of specialization in Computer Science under the guidance of a faculty member. Objectives are to integrate the classroom material from several courses, and to apply them to solve practical problems. May be graded PP.

COMP 398   Final Year Project II   [0-0-12:4]
Continuation of COMP 397.

Postgraduate Courses:

COMP 512   Advanced Distributed Software Development   [3-0-0:3]
Introduction to important advanced concepts of software development in distributed environments. Topics include models and analysis, object-oriented methodologies for enterprise applications, web technologies for building e-business systems.

COMP 520   Fundamentals of Digital Image Processing   [3-0-0:3]
A postgraduate level course in digital image processing, which provides students with a sound background in this field. Topics include image processing and analysis in the spatial and frequency domains, image restoration and compression, image segmentation, morphological image processing, representation and description, and related application areas and some closely related topics. *Exclusion*: ELEC 532

COMP 522   Machine Learning   [3-0-0:3]
Introduction to major learning paradigms and techniques, basic applied statistics and information theory, decision trees, neural networks, Bayesian classification, kernel methods, clustering, density estimation, feature selection and extraction, hidden Markov models, reinforcement learning, case-based learning, model selection and various applications. *Background*: COMP 171, probability theory and linear algebra

COMP 524   Computer Vision   [3-0-0:3]
Introduction to techniques for automatically describing visual data and tools for image analysis; perception of spatial organization; models of general purpose vision systems; computational and psychological models of perception. *Background*: COMP 221; knowledge in linear algebra

COMP 526   Natural Language Processing   [3-0-0:3]
Techniques for parsing, interpretation, context modeling, plan recognition, generation. Emphasis on statistical approaches, neuropsychological and linguistic constraints, large text corpora. Applications include machine translation, dialogue systems, cognitive modeling, knowledge acquisition. *Background*: COMP 221

COMP 527   Pattern Recognition   [3-0-0:3]
Fundamentals of pattern recognition techniques. Statistical decision theory. Parametric density estimation. Nonparametric density estimation. Discriminant functions. Feedforward neural networks. Feature selection and extraction. Clustering. Mixture density estimation. Hidden Markov models. *Background*: Knowledge of linear algebra and probability. *Exclusion*: CSIT 522

COMP 530   Database Architecture and Implementation   [3-0-0:3]
Introduction to the relational model and SQL. System architectures and implementation techniques of database management systems: disk and memory management, access methods, implementation of relational operators, query processing and optimization, transaction management and recovery. Hands on experience with building the components of a small DBMS. *Background*: COMP 252

COMP 537   Knowledge Discovery in Databases   [3-0-0:3]
An introduction to knowledge discovery in databases. Different discovery and learning techniques are presented and compared. Automatic generation of query language expressions is discussed in depth. Potential applications are shown. *Background*: COMP 231

COMP 538   Reasoning and Decision under Uncertainty   [3-0-0:3]
AI methods of reasoning and decision under uncertainty. Probability theory; Bayesian networks. Bayesian decision theory; influence diagrams. Markov decision processes; planning under uncertainty. Learning with Bayesian networks. Other approaches. Applications. *Background*: Knowledge of probability

COMP 540   Mathematical Introduction to Computer Vision and   [3-0-0:3]
                 Graphics
This course will cover the fundamental geometric and numerical tools for computer vision, graphics, and robotics. Euclidean geometry, projective geometry, curves and surfaces, and numerical optimization methods. *Background*: Programming, linear algebra *Exclusion*: CSIT 540

COMP 561   Computer Networks   [3-0-0:3]
Principles, design and implementation of computer communication networks; network architecture and protocols, OSI reference model and TCP/IP networking architecture; Internet applications and requirements; transport protocols, TCP and UDP; network layer protocols, IP, routing, multicasting and broadcasting; local area networks; data link and physical layer issues; TCP congestion control, quality of service, emerging trends in networking. *Exclusion*: COMP 362

COMP 572   Introduction to Combinatorial Optimization   [3-0-0:3]
An introduction to the basic tools of combinatorial optimization, including network flow and the max-flow min-cut theorem, linear programming, matching, spanning trees and matroids, dynamic programming, algorithms and data structures, graph algorithms. *Background*: COMP 271 or equivalent, linear algebra

COMP 573   Computational Geometry   [3-0-0:3]
An introductory course in Computational Geometry. Algorithms for manipulating geometric objects. Topics include Convex Hulls, Voronoi Diagrams, Point Location, Triangulations, Randomized Algorithms, Point-Line Duality. *Background*: COMP 271

COMP 581   Cryptography and Security   **[3-0-0:3]**
[Previous Course Code: COMP 685A] Classical encryption techniques, block and stream ciphers, public-key cryptography, authentication, nonrepudiation, key management, digital signatures, public key infrastructure, cryptographic protocol, secret sharing, electronic mail security, IP security, Web security, Firewalls, Intrusion detection. *Background*: Computer networks *Exclusion*: CSIT 571

COMP 587   Parallel Processing: Software   **[3-0-0:3]**
Software aspects of parallel processing systems including parallel programming paradigms, complex problem solving techniques using high performance computing, parallel algorithms, parallelism management, scheduling, mapping, load balancing, parallel languages, and parallelization compilers. *Background*: COMP 252 and COMP 271

COMP 610   Topics in Software Engineering   **[3-0-0:3]**
Selected topics in software engineering of current interest to the Department and not covered by existing courses.

COMP 621   Advanced Topics in Artificial Intelligence   **[3-0-0:3]**
Advanced topics in artificial intelligence including neural networks, natural language processing, logic programming, image understanding, robotics and others. *Background*: an appropriate 500-level course.

COMP 630   Topics in Database Systems   **[3-0-0:3]**
Selected topics in database systems of current interest to the Department and not covered by existing courses.

COMP 641   Topics in Graphics   **[3-0-0:3]**
Selected topics in graphics of current interest to the Department and not covered by existing courses.

COMP 651   Topics in Computer Systems Analysis   **[3-0-0:3]**
Advanced topics in computer systems analysis; issues in the development and solution of system models; model parametrization, verification and validation; recent developments in techniques and tools for system evaluation.

COMP 660   Topics in Computer and Communication Networks   **[3-0-0:3]**
Advanced topics in communication networks, including issues in high speed networking, ATM, multimedia communication, network interconnection, network management, and protocol verification and testing.

COMP 670   Topics in Theoretical Computer Science   **[3-0-0:3]**
Selected topics in theoretical computer science not covered by existing courses, including, but not limited to, computational complexities and computability, graph algorithms and combinatorial optimization.

COMP 680   Topics in Computer Engineering   **[3-0-0:3]**
Selected topics in computer engineering of current interest to the Department and not covered by existing courses.

COMP 685   Topics in Applications of Computer Science   **[3-0-0:3]**
Selected topics in applications of computer science not covered by existing course.

COMP 690   Computer Science Seminar I   **[0-1-0:1]**
A regular seminar presenting research problems currently under investigation. Students are expected to attend regularly. Graded P or F.

COMP 691   Computer Science Seminar II   **[0-1-0:1]**
A regular seminar presenting research problems currently under investigation. Students are expected to attend regularly. Graded P or F.

COMP 693   Research Project   **[1-3 credit(s)]**
An independent research project carried out under the supervision of a faculty member. This course is only available for exchange, visiting and visiting internship students.

COMP 696-697 Independent Studies   **[1-3 credit(s)]**
An independent research project carried out under the supervision of a faculty member. (Only one independent studies course may be used to satisfy the course requirements for any postgraduate program.)

COMP 698   MSc Research Project   **[0-0-12:4]**
An independent research project carried out under the supervision of a faculty member. A project report is required and must be approved by two faculty members, one of whom is the supervisor.

COMP 699   MPhil Thesis Research
Master's thesis research supervised by a faculty member. A successful defense of the thesis leads to Pass. No course credit is assigned.

COMP 799   Doctoral Thesis Research
Original and independent doctoral thesis research supervised by a faculty member. A successful defense of the thesis leads to Pass. No course credit is assigned.