REGULATIONS FOR THE DEGREE OF
MASTER OF SCIENCE IN COMPUTER SCIENCE
(MSc[CompSc])

(See also General Regulations)

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

The degree of Master of Science in Computer Science (MSc[CompSc]) is a postgraduate degree awarded for the satisfactory completion of a course of study in the Faculty of Engineering. The MSc(CompSc) course is offered in part-time and full-time mode.

MCS 1 Admission requirements

To be eligible for admission to the courses leading to the degree of Master of Science in Computer Science, a candidate
- (a) shall comply with the General Regulations;
- (b) shall hold
  - (i) a Bachelor's degree in Computer Science; *or*
  - (ii) any relevant qualification of equivalent standard from this University or from another university or comparable institution accepted for this purpose; and
- (c) shall satisfy the examiners in a qualifying examination if required.

MCS 2 Qualifying examination

- (a) A qualifying examination may be set to test the candidate's formal academic ability or his ability to follow the courses of study prescribed. It shall consist of one or more written papers or their equivalent and may include a project report.
- (b) A candidate who is required to satisfy the examiners in a qualifying examination shall not be permitted to register until he has satisfied the examiners in the examination.

MCS 3 Award of degree

- (a) To be eligible for the award of the degree of Master of Science in Computer Science a candidate
  - (i) shall comply with the General Regulations; and
  - (ii) shall complete the curriculum and satisfy the examiners in accordance with the regulations set out below.
- (b) A candidate who has not satisfied the examiners for the award of the Degree of Master of Science in Computer Science but has completed 8 modules may be awarded a Postgraduate Diploma in Science (Computer Science) [PDipSc(CS)], subject to approval of the Faculty Board.

MCS 4 Length of curriculum

For the part-time mode of study, the curriculum shall normally take two academic years of study, and the maximum period of study is three years. For the full-time mode of study, the curriculum shall normally take one academic year of study, and the maximum period of study is two years.

MCS 5   **Completion of curriculum**

(a)   To complete the curriculum a candidate shall, within the prescribed maximum period of study stipulated in Regulation MCS 4 above:
(i)   follow courses of instruction and complete satisfactorily all prescribed written work;
(ii)   satisfy the examiners in all forms of assessment as may be required in either
(1)   twelve modules which may include a project report or dissertation of four modules; *or*
(2)   at least nine modules successfully completed at this University (which may include a project report or dissertation of four modules) and not more than three modules successfully completed at this or another university before admission to the Master of Science in Computer Science and approved by the Faculty Board.
(b)   A candidate who fails to fulfil the requirements within the period of study specified in Regulation MCS 4 above shall be recommended for discontinuation under the provisions of General Regulation G 12, except that a candidate, who is unable because of illness or circumstances beyond his control to complete the requirements within the prescribed period of study, may apply for permission to extend his period of studies. Any such application shall be made within two weeks of the first day of the examination paper in question.

MCS 6   **Course selection**

(a)   Selection of study patterns shall be made in consultation with and be subject to the approval of the Head of the Department of Computer Science.
(b)   Subject to the approval of the Head of the Department of Computer Science, a student may be permitted to select at most two modules from the syllabuses for the degrees of MSc(ECom&IComp) and MSc(Eng).
(c)   Subject to the approval of the Faculty Higher Degrees Committee on the recommendation of the Head of the Department of Computer Science, a candidate may be permitted to select additional module(s).

MCS 7   **Project report or dissertation**

(a)   A candidate who is permitted to select a project report or dissertation of 4 modules is required to submit it by a date specified by the Board of Examiners.
(b)   The candidate shall submit a statement that the project report or dissertation represents his own work (or in the case of conjoint work, a statement countersigned by his co-worker, which shows his share of the work) undertaken after registration as a candidate for the degree.

MCS 8   **Examinations**

(a)   The written examination for each module shall be held after the completion of the prescribed course of study for that module, and not later than January, May or August immediately following the completion of the course of study for that module.
(b)   A candidate who has failed to satisfy the examiners in a module or modules may be permitted to present himself either for re-examination in the module or modules of failure or for examination in the same number of new modules when the examination is next held,

but a candidate who has twice failed to satisfy the examiners in the module or modules for the same module shall not be permitted to present himself for examination in the same module or modules for a third time. To proceed to the following year of the curriculum, a candidate must satisfy the examiners in a minimum of two modules in each academic year. A candidate who passes in less than two modules in an academic year may be recommended for discontinuation of studies under the provisions of General Regulations G 12.

(c) A candidate who has presented an unsatisfactory project report or dissertation may be required to submit a revised project report or dissertation on the same subject within a specified period.

(d) A candidate who has presented an unsatisfactory project report or dissertation for a second time shall be recommended for discontinuation of studies under the provisions of General Regulation G 12.

(e) A candidate who has failed to submit a satisfactory project report or dissertation within the prescribed maximum period of study, including any extension, shall be recommended for discontinuation of studies under the provisions of General Regulation G 12.

MCS 9   Examination results

At the conclusion of the examination and after presentation of the project reports or dissertations, a pass list shall be published. A candidate who has shown exceptional merit or merit at the whole examination may be awarded a mark of distinction or credit, as appropriate, and this mark shall be recorded on the candidate's degree diploma.

SYLLABUSES FOR THE DEGREE OF
MASTER OF SCIENCE IN COMPUTER SCIENCE
(MSc[CompSc])

The curriculum extends over two to three academic years of part-time or one to two academic years of full-time study.

The following is a list of modules offered by the Department of Computer Science. The list below is not final and some modules may not be offered every year.
Candidates may also in exceptional circumstances select at most 2 modules from the syllabuses for the degree of MSc(Eng) and that for the degree of MSc(ECom&IComp), subject to approval of the Head of the Department or Course Co-ordinator concerned, and in accordance with the provisions of Regulation MCS 6(b).

Candidates who have failed to satisfy the examiners for the Degree of Master of Science in Computer Science may on termination of their study be awarded a Postgraduate Diploma in Science (Computer Science), subject to approval of the Faculty Board.

COMP7102   Transaction processing

The goal is to study the fundamentals of database transaction processing, with emphasis on advanced transaction processing techniques. Topics may include serializability theory, concurrency control protocols, database recovery protocols, distributed transaction processing, real-time databases.

COMP7103   Data mining

Data mining is the automatic discovery of statistically interesting and potentially useful patterns from large amounts of data. The goal of the course is to study the main methods used today for data mining and on-line analytical processing. Topics include Data Mining Architecture; Data Preprocessing; Mining Association Rules; Classification; Clustering; On-Line Analytical Processing (OLAP); Data Mining Systems and Languages; Advanced Data Mining (Web, Spatial, and Temporal data).

COMP7201   Analysis and design of enterprise applications in UML

This course presents an industrial-strength approach to software development based on the object-oriented modelling of business entities. Topics include overview of object-oriented concepts; Unified Modelling Language (UML); object modelling using use cases and class diagrams; dynamic modelling using sequence, interaction and state diagrams; mapping object models to implementation models such as relational databases; and current trends in object technologies, such as components, design patterns and XML. Emphasis will be given on hands-on exercises with the use of CASE tools. Prerequisites: A course in object-oriented programming and a course in software engineering or systems analysis and design.

COMP7202   Software quality assurance

This course presents current issues and solutions for ensuring the quality of enterprise systems. Topics include software quality concepts; software quality models; requirements tracking and management; code quality; reviews and inspections; software testing; software quality metrics and measurement; version control and configuration management; and software process improvement.

Prerequisites: A course in object-oriented programming and a course in software engineering or systems analysis and design.

COMP7203   Modern software design

The practice of software design has changed markedly in recent years as new approaches to design have gained broad acceptance and several have progressed to become mainstream techniques themselves. This course introduces the principles and practical application of these modern approaches. It first reviews the goals of software design and the qualities that differentiate good designs from bad ones. From this foundation it teaches elemental design patterns, classic design patterns and anti-patterns, refactoring, refactoring to patterns, test-driven design and design for test. Implementation issues, programming idioms and effective use of the language are introduced and discussed where appropriate.
Prerequisites: A course in software engineering or analysis and design of software systems. The course also requires the ability to program in Java and a basic understanding of the UML class and sequence diagrams.

COMP7204   Project management

A disciplined project management approach is one of the critical success factors to project success. This course provides students with an insight and appreciation of the project management framework as advocated by Project Management Institute (PMI). These industry best practices are being recognized as US national standards by ANSI. The course is intended to offer a combination of lectures on project management concepts / theories, as well as experience sharing by the instructor and guest speakers. Topics include the studies of most of the nine knowledge areas, such as Scope Management, Time Management, Cost Management, Risk Management, Communications Management, Human Resource Management, Project Leadership and PMO. This will enrich students' understanding of the subject matter with the opportunities to participate in an interactive learning environment under a classroom setting.

COMP7205   Enterprise architecture

This course aims to teach students the practical skills in modeling and developing enterprise IT architectures. It covers different enterprise architecture frameworks, methodologies and practices (such as TOGAF and Zachman). Students will also learn common enterprise integration patterns for implementation of complex enterprise applications based on Service-Oriented Architecture (SOA). New architecture trends (e.g., cloud computing, shared-nothing architecture, column-based database) will also be introduced.

COMP7301   Computer and network security

The aim of the course is to introduce different methods of protecting information and data in computer and information systems from unauthorized disclosure and modification. Topics include introduction to security; cryptographic algorithms; cryptographic infrastructure; internet security; secure applications and electronic commerce.

COMP7302   Pervasive and mobile computing

Pervasive computing, often synonymously called ubiquitous computing, is to create ambient intelligence where network devices embedded in the environment provide unobtrusive connectivity and services all the time. These intelligent devices work cooperatively and autonomously to collect, process and transport information, in order to adapt to the associated context and activity, thus improving human experience and quality of life. In this course, we will study the following topics: (1) Software infrastructure for pervasive computing, (2) Sensors architecture and embedded OS, (3) Data routing protocols for wireless sensor networks, (4) Discovery protocols for spontaneous interaction between appliances and services, (5) Context modeling and reasoning techniques for realizing context-aware applications, and (6) Security and privacy solutions to protect access to user context information. Students are expected to complete a context-aware mobile application in a J2ME or Android platform.
Prerequisites: Students are required to have at least one course in networking and operating systems. Programming experience in Java is required.

COMP7303   High-performance computing

This module offers an overview of state-of-the-art parallel architectures and programming languages. The students will learn the issues related to the performance of parallel algorithms, and how to design efficient parallel algorithms for parallel machines. Topics include milestones in the history of HPC and its applications; high-performance computing architectures; performance law; modern CPU design; interconnection network and routing techniques; memory hierarchy and cache coherence protocol; parallel algorithm design; parallel programming models and case studies of supercomputers.

COMP7304   The wireless Internet and mobile network

This module offers students an opportunity to understand the principles and technologies behind data services in a wireless, mobile environment. It introduces the developing areas of mobile computing technology and applications. Topics include key features of 1G, 2G, and 3G mobile technology; wireless LANs; personal area networks and Bluetooth; ad hoc networks; mobile IP, DHCP, IPv6; TCP over wireless; proxy systems; web surfing and WAP; mobile file systems; privacy, authentication, security; mobility and location-dependent/personalized wireless applications.

COMP7305   Cluster and cloud computing

This module offers an overview of current cluster and cloud technologies, and discusses various issues in the design and implementation of cluster and cloud systems. Topics include cluster hardware architecture (e.g., multicore, GPU, high-speed network), middleware design for realizing the concept of single system image (e.g., software distributed shared memory, cluster file systems) and virtualization techniques (e.g., Xen, KVM, Hyper-V) used in current data centers. We will also discuss three types of Cloud computing platforms, including SaaS, PaaS, and IaaS, by providing motivating examples from companies such as Google, Amazon, and Microsoft; and introduce Map/Reduce programming paradigm for large-scale data analysis. Students will be organized into groups for their project work and in-class presentations.
Prerequisites: The students are expected to exercise the systems configuration and administration under a Linux cluster. Basic understanding of Linux operating system and some experiences in system level programming (C/C++ or Java) are required.

COMP7306   Web technologies

This course aims to give students a basic understanding of various Web technologies and their industry applications. Fundamental XML concepts and techniques, such as XML Schema, XSLT, SAX, and DOM, will be introduced. New technologies related to Web 2.0, web services, service oriented architecture (SOA), and cloud computing will be studied, including RSS, ATOM, Ajax, SOAP, WSDL, ebXML.
Prerequisites: basic web programming knowledge, e.g. HTML, JavaScript, and Java.

COMP7307   Advanced real-time embedded systems and applications

This module's objective is to introduce advanced real-time scheduling techniques, design and implementation considerations for Embedded Systems. It covers topics on real-time scheduling algorithms, microcontroller architecture, Digital Signal Processors (DSP) architecture, System-on-Chips (SoC), real-time operating systems, and case studies on real-time applications.
Prerequisites: COMP0230 "Operating systems" or equivalent

COMP7403   Computational molecular biology

To introduce computational methods and data structures for analyzing biological data (e.g. DNA, RNA and protein sequences). Typical topics include basics of molecular biology; biological sequence analysis; indexing data structures; RNA secondary structure alignment/prediction and phylogeny.

COMP7404   Computational intelligence and machine learning

This course will teach a broad set of principals and tools that will provide the mathematical and algorithmic framework for tackling problems using Artificial Intelligence (AI) and Machine Learning (ML). AI and ML are highly interdisciplinary fields with impact in different applications, such as, biology, robotics, language, economics, and computer science. AI is the science and engineering of making intelligent machines, especially intelligent computer programs, while ML refers to the changes in systems that perform tasks associated with AI.
Topics may include a subset of the following: problem solving by search, heuristic (informed) search, constraint satisfaction, games, knowledge-based agents, supervised learning, unsupervised learning; learning theory, reinforcement learning and adaptive control.
Pre-requisites: Nil, but knowledge of data structures and algorithms, probability, linear algebra, and programming would be an advantage.

COMP7405   Techniques in computational finance

This course introduces the major computation problems in the field of financial derivatives and various computational methods/techniques for solving these problems. The lectures start with a short introduction on various financial derivative products, and then move to the derivation of the mathematical models employed in the valuation of these products, and finally come to the solving techniques for the models.
Pre-requisites: No prior finance knowledge is required. Students are assumed to have basic competence in calculus and probability (up to the level of knowing the concepts of random variables, normal distributions, etc.). Knowledge in at least one programming language is required for the assignments/final project.

COMP7406   Software development for quantitative finance

This module introduces the tools and technologies widely used in industry for building applications for Quantitative Finance. From analysis and design to development and implementation, this course covers: modeling financial data and designing financial application using UML, a de facto industry standard for object oriented design and development; applying design patterns in financial application; basic skills on translating financial mathematics into spreadsheets using Microsoft Excel and VBA; developing Excel C++ add-ins for financial computation.
Pre-requisites: This module assumes basic understanding of financial concepts covered in COMP7802. Experience in C++/C programming is required.

COMP7502   Image processing and computer vision

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

COMP7503   Multimedia technologies

To study selected topics of multimedia technologies in depth.   Topics vary, and may include compression algorithms, psychoacoustics, psychovision, storage systems, and media streaming.

COMP7504   Pattern recognition and applications

To study techniques in pattern recognition.   Topics include statistical decision theory; density estimation; dimension reduction; discriminant functions; unsupervised classification and clustering; neural network; hidden Markov model; and selected applications in pattern recognition such as characters and speech recognition.

COMP7505   User interface design and development

For technology products and services, the user experience is the key to success. With the advanced development of processors, sensors, devices, algorithms and software tools, more possibilities of user interface can be created to improve or solve the human machine interface and operations. The course will study various input and output devices, software and hardware considerations, use case investigations.

COMP7506   Smart phone apps development

Smart phones have become very popular in recent years. For iPhones alone, 50,000,000 pieces were sold worldwide in 2009. In addition to iPhones, there are also Android phones, Symbian phones as well as Windows phones. Smart phones play an important role in mobile communication and applications.

Smart phones are powerful as they support a wide range of applications (called apps). Most of the time, smart phone users just purchase their favorite apps wirelessly from the vendors. There is a great potential for software developer to reach worldwide users.

This course aims at introducing the design issues of smart phone apps. For examples, the smart phone screen is usually much smaller than the computer monitor. We have to pay special attention to this aspect in order to develop attractive and successful apps. Different smart phone apps development environments and programming techniques (such as Java for Android phones, C# for Windows Phones and Objective-C for iPhones) will be introduced to facilitate students to develop their own apps.

Prerequisites: Students should have basic programming knowledge, e.g. C++ or Java.

COMP7603   Software for robotics and mechatronics

More and more robotics and mechatronic systems are used to produce high-quality, economical products for an ever demanding world, and also help our daily life. The system for interacting with real world is more complex than the virtual world, and need software for communicate with various mechanical, electrical and electronics system. This ensure effective operate and solving problem in this complex environment.

COMP7604   Game design and development

The course will study various topics in game design, for computer, smartphone, mobile device and game console. Topics includes: history and types of game, game platforms, design of game, cross platform consideration, 3D model, project management, AI, sound effects, and networking.

COMP7605   Advanced multimedia data analysis and applications

This module's objective is to introduce advanced multimedia data analysis techniques, and the design and implementation of signal processing algorithms. It covers topics on digital filter realization, FIR and IIR filters, relation between z-transform and fourier transform, two-dimensional signal processing, and application of multimedia signal processing to speech production and analysis, image and video processing.

COMP7702   Project (4 modules)

Candidate will be required to carry out independent work on a major project that will culminate in the writing of a dissertation.

COMP7801   Topic in computer science

Selected topics that are of current interest will be discussed.

COMP7802   Introduction to financial computing

This module introduces the students to various different aspects of financial computing in the investment banking area. The topics include yield curve construction in practice, financial modelling and modern risk management practice, etc. Financial engineering is an area of growing demand. The module is a combination of financial knowledge, mathematics and computational techniques. This

module will be suitable for students who want to pursue a career in this fast growing area.

This is a very practical course. There is no examination and the course is assessed on the basis of individual assignments and a final project to be done individually or as a group.

Prerequisites: This module does not require any prior knowledge in the area of finance. Basic calculus and numeric computational techniques are useful. Knowledge in Excel spreadsheet operations is required to complete the assignments and final project.

COMP7804   E-commerce security cases and technologies

This module provides students knowledge about modern e-commerce security, through the study of various cases. It covers fundamental concepts in security technology so as to equip the students with enough background knowledge in security, and then covers the impact of the modern e-commerce environment to the changing demand of security. After that a bundle of cases will be covered, such as cases in communication security, cases in Internet security, cases in data security including personal data protection in both client-side and server-side, and application security cases. With the experience of studying these cases, the students will be asked to assess or design security solutions to some given e-commerce security problems, so as to acquire the ability to apply the learnt security technology to real-life cases.

COMP7805   Topic in computer network and systems

Selected topics in computer network and systems that are of current interest will be discussed.

COMP7806   Topic in computer security

Selected topics in computer security that are of current interest will be discussed.

COMP7901   Legal protection of digital property

This module introduces computer professionals to the various legal means of protecting digital property including electronic data, computer software, electronic databases, IP addresses in the form of domain names, and any work or innovation in digital form. Focus is on the main issues in protecting digital property arising from developments in information technology, and their legal solutions. Topics covered include, but are not limited to, the following: 1) Software copyright, 2) Legal protection of electronic databases, 3) Patent protection of software and algorithms, 4) Legal protection of domain names and websites, 5) Legal protection of electronic data and trade secrets.

COMP7902   Wireless network security

The objective of this course is to introduce security technologies commonly used in wireless networks. Topics include basics of security mechanisms, various security technologies used in wireless networks such as Bluetooth, Wi-Fi, mobile cellular networks. Wireless security aspects in the integration of wired and wireless mobile technologies will be discussed.

COMP7903   Digital investigation and forensics

This course introduces the fundamental principles of digital investigation and forensics. The course starts with a brief introduction to common computer crimes and digital evidence, and then moves on to the computer basics and network basics pertaining to digital forensics, and finally comes to the techniques for digital investigation and forensic examination.

Elective Graduate Courses

The exact topics and contents of these courses may vary from year to year. Interested students should refer to the programme's online pages (http://www.cs.hku.hk/msc) for further information.

COMP8101   Advanced topics in data engineering

This course will discuss and study research topics and current problems of interest in the field of data engineering.

COMP8201   Advanced topics in software engineering

This course will discuss and study research topics and current problems of interest in the field of software engineering.
Prerequisite: A course in object-oriented programming.

COMP8301   Advanced topics in computer systems

This course will discuss and study research topics and current problems of interest in the field of computer systems.

COMP8501.   Advanced topics in computer graphics

This course will study advanced topics in modeling, animation and rendering as well as discuss current research problems in the field of computer graphics.

COMP8502   Advanced topics in pattern recognition

This course will discuss and study research topics and current problems of interest in the field of pattern recognition.

COMP8503   Advanced topics in visual analytics

This course presents the theory, algorithms and applications of visual analysis and information visualization. Main topics to be included: basic charts and graphs; hierarchical structure visualization; graph drawing; network visualization; focus+context; database visualization; clustering; multidimensional scaling; manifold learning; anomaly detection.

COMP8504   Geometric modelling and computing

This course is designed to provide the students with systematic training to understand the state-of-the-art methods in geometric modelling and computing. It covers basic theories, such as affine geometry, differential geometry, algebraic geometry, as well as applications to shape modelling and process, including shape modelling, geometric processing, and mesh generation. The students will have opportunities to present and discuss recent advances in shape modelling and geometric computing. The students are encouraged to work on course projects that apply the concepts and techniques they learn in the course to solve problems in their own fields of research.

COMP8601   Advanced topics in theoretical computer science

This course will discuss and study research topics and current problems of interest in theoretical computer science.

COMP8802   Foundations on digital forensics and security

This course presents the foundations of information security and digital forensics. Topics include: cryptography, system security, software security, steganography and watermarking, network security including Web security, authentication systems and access control, computer forensics models, different digital forensics techniques including real-time forensics, file system forensics, network forensics and mobile forensics.
Pre-requisites:
(1) CSIS0327/COMP3327 "Computer and network security" or equivalent
(2) CSIS0230/COMP3230 "Principles of operating systems" or equivalent

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