NUS School of Computing
Graduate Certificate in Computing Foundations
Course Details

Annex A – SoC
GC-CF

Course Code & Title	Pre-Requisite[1]	Co-Requisite[2]	Preclusion[3]	Description
Graduate Certificate in Computing Foundations				
IT5001 Software Development Fundamentals				This course aims to introduce non-computing students to the principles and concepts of software development at an accelerated pace. Students will be introduced to the basics of programming (control flow, code and data abstraction, recursion, types, OO), development methodology (ensuring correctness, testing, debugging), simple data structures and algorithms (lists, maps, sorting), and software engineering principles. Through hands on assignments and projects, students will learn good software development practices (documentation, style) and experience a typical software engineering cycle (waterfall and agile workflow).
IT5002 Computer Systems and Applications		IT5001 Software Development Fundamentals		This course aims to introduce non-computing students to (a) the common principles and concepts in computer systems: abstraction, layering, indirection, caching, hierarchical naming, prefetching, pipelining, locking, concurrency; (b) the inner workings of a computing device, including hardware (CPU, memory, disks), operating systems (kernels, processes and threads, virtual memory, files), and applications (Web, databases).
IT5003 Data Structures and Algorithms	IT5001 Software Development Fundamentals			This course introduces non-computing students to efficient computational problem solving in an accelerated pace. Students will learn to formulate a computational problem, identify the data required and come up with appropriate data structures to represent them, and apply known strategies to design an algorithm to solve the problem. Students will also learn to quantify the space and time complexity of an algorithm, prove the correctness of an algorithm, and the limits of computation. Topics include common data structures and their algorithms (lists, hash tables, heap, trees, graphs), algorithmic problem-solving paradigms (greedy, divide and conquer, dynamic programming), and NP-completeness.

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[2] Co-requisites are courses that can be taken concurrently.
[3] A course may specify certain preclusions. These are courses that have similar emphases and may not be taken together with that particular course.

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IT5004 Enterprise Systems Architecture Fundamentals		IT5001 Software Development Fundamentals		This course aims to equip non-computing students with fundamental knowledge in architecting and designing modern Enterprise Systems in organisations that can be reasonably complex, scalable, distributed, component-based and mission-critical. Students will develop an understanding of high-level concepts such as enterprise architecture and software architecture. They will then move on to acquire fundamental systems analysis and design techniques such as object-oriented requirements analysis and design using the Unified Modelling Language.
IT5005 Artificial Intelligence	IT5001 Software Development Fundamentals (Advisory)			The study of artificial intelligence, or AI, aims to make machines achieve human-level intelligence. This course provides a comprehensive introduction to the fundamental components of AI, including how problem-solving, knowledge representation and reasoning, planning and decision making, and learning. The course prepares students without any AI background to pursue advanced courses in AI.
IT5006 Fundamentals of Data Analytics	IT5001 Software Development Fundamentals		BT5126 Hands-on with Business Analytics IS5126 Hands-on with Applied Analytics CS5228 Knowledge Discovery and Data Mining	This course introduces students to the fundamental concepts in business analytics. They can learn how to apply basic business analytics tools (such as R), and how to effectively use and interpret analytic models and results for making informed business decisions. The course prepares students without any analytics background to pursue advanced courses in business and data analytics.

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IT5007 Software Engineering on Application Architecture	IT5001 Software Development Fundamentals	IT5003 Data Structures and Algorithms		To meet changing business needs, this course focuses on flexible and agile software development on modern application architecture. Students learn to design and develop modern applications that support multiple clients across different platforms such as desktop, mobile devices and cloud. The course covers designing (1) website-based front-end software and (2) mobile app front-end that interacts with a common cloud-based backend. The final part involves engineering software for higher-level objectives such as security and performance. Tools and techniques for writing modern software, such as, HTML5, CSS3, React.js, Node.js, MySQL/MongoDB, and Git will be taught.
IT5008 Database Design and Programming				The aim of this course is to introduce the fundamental concepts and techniques necessary for the understanding and practice of design and implementation of database applications and of the management of data with relational database management systems. The course covers practical and theoretical aspects of design with entity-relationship model, theory of functional dependencies and normalization by decomposition in third and Boyce-Codd normal forms. The course covers practical and theoretical aspects of programming with SQL data definition and manipulation sublanguages as well as relational algebra/calculus.

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