

**DEPARTMENT OF COMPUTER SCIENCE**

**Student Handbook 2020-21 / Appendix C / Postgraduate Taught  
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## CSMS MSc Computer Science

**Students must ensure that Section 3.8.2 (Pre-requisite and Co-requisite Information for CS Modules) of the main Student Handbook file has been checked when considering which optional modules to select.**

January 2021 starters must follow the Full-Time Pathway as outlined below.

<b>Structure</b>					
<b>Year 1 Semester 1</b>					
Code	Module	Credit	Level	Type	Pathway(s)
COMP518	Database and Information Systems 2020-21	15	Level 7	Required	
COMP517	Programming Fundamentals 2020-21	15	Level 7	Required	
COMP516	Research Methods in Computer Science 2020-21	15	Level 7	Required	
COMP519	Web Programming 2020-21	15	Level 7	Required	
<b>Year 1 Semester 2</b>					
Options totalling 60 credits from the following modules provided pre-requisites are satisfied.					
Code	Module	Credit	Level	Type	Pathway(s)
COMP526	APPLIED ALGORITHMICS 2020-21	15	Level 7	Optional	
COMP575	Computational Intelligence 2020-21	15	Level 7	Optional	
COMP527	Data Mining and Visualisation 2020-21	15	Level 7	Optional	
COMP532	Machine Learning and BioInspired Optimisation 2020-21	15	Level 7	Optional	
COMP524	SAFETY AND DEPENDABILITY 2020-21	15	Level 7	Optional	
<b>Year 1 Semester 3</b>					
COMP702 is the MSc 60 credit project module that will run from August 2020 to January 2021.					
Code	Module	Credit	Level	Type	Pathway(s)
COMP702	MSc Project 2020-21	60	Level 7	Required	

## CSAD MSc Advanced Computer Science

**Students must ensure that Section 3.8.2 (Pre-requisite and Co-requisite Information for CS Modules) of the main Student Handbook file has been checked when considering which optional modules to select.**

January 2021 starters must follow the Full-Time Pathway as outlined below.

<b>Structure</b>					
<b>Year 1 Semester 1</b>					
Options totalling 45 credits from the following modules provided pre-requisites are satisfied.					
Code	Module	Credit	Level	Type	Pathway(s)
COMP523	Advanced Algorithmic Techniques 2020-21	15	Level 7	Optional	
COMP528	Multi-Core and Multi-Processor Programming 2020-21	15	Level 7	Optional	
COMP522	Privacy and Security 2020-21	15	Level 7	Optional	
COMP516	Research Methods in Computer Science 2020-21	15	Level 7	Required	
<b>Year 1 Semester 2</b>					
Options totalling 60 credits from the following modules provided pre-requisites are satisfied.					
Code	Module	Credit	Level	Type	Pathway(s)
COMP559	ALGORITHMIC GAME THEORY 2020-21	15	Level 7	Optional	
COMP575	Computational Intelligence 2020-21	15	Level 7	Optional	
COMP527	Data Mining and Visualisation 2020-21	15	Level 7	Optional	
COMP532	Machine Learning and BioInspired Optimisation 2020-21	15	Level 7	Optional	
COMP524	SAFETY AND DEPENDABILITY 2020-21	15	Level 7	Optional	
<b>Year 1 Semester 3</b>					
COMP702 is the MSc 60 credit project module that will run from August 2020 to January 2021.					
Code	Module	Credit	Level	Type	Pathway(s)
COMP702	MSc Project 2020-21	60	Level 7	Required	

## CDSM MSc Data Science and Artificial Intelligence

**Students must ensure that Section 3.8.2 (Pre-requisite and Co-requisite Information for CS Modules) of the main Student Handbook file has been checked when considering which optional modules to select.**

January 2021 starters must follow the Full-Time Pathway as outlined below.

<b>Structure</b>					
<b>Year 1 Semester 1</b>					
Code	Module	Credit	Level	Type	Pathway(s)
COMP533	Maths and Statistics for AI and Data Science 2020-21	15	Level 7	Required	
COMP517	Programming Fundamentals 2020-21	15	Level 7	Required	
COMP516	Research Methods in Computer Science 2020-21	15	Level 7	Required	
<b>Year 1 Semester 1 optional modules</b> Choose one module from the following, based on individual preference.					
Code	Module	Credit	Level	Type	Pathway(s)
COMP518	Database and Information Systems 2020-21	15	Level 7	Optional	
COMP519	Web Programming 2020-21	15	Level 7	Optional	
<b>Year 1 Semester 2</b>					
Code	Module	Credit	Level	Type	Pathway(s)
COMP534	Applied Artificial Intelligence 2020-21	15	Level 7	Required	
COMP527	Data Mining and Visualisation 2020-21	15	Level 7	Required	
<b>Year 1 Semester 2 optional modules</b> Choose two modules from the following, based on individual preference.					
Code	Module	Credit	Level	Type	Pathway(s)
COMP575	Computational Intelligence 2020-21	15	Level 7	Optional	
COMP532	Machine Learning and BioInspired Optimisation 2020-21	15	Level 7	Optional	
<b>Year 1 Semester 3</b> COMP702 is the MSc 60 credit project module that will run from August 2020 to January 2021.					
Code	Module	Credit	Level	Type	Pathway(s)
COMP702	MSc Project 2020-21	60	Level 7	Required	

## Summary Information on Modules

### Module Descriptions – Semester 1

#### ***COMP516 Research Methods in Computer Science***

This module includes various "high order transferable skills" such as: searching for information on the WWW and libraries, reading and understanding research papers, writing papers (including referencing), a review of professional ethics and legal issues, problem solving, and the development and conduct of research programmes. There are 30 lectures and 10 hours of practical work.

#### ***COMP517 Programming Fundamentals***

This module provides a comprehensive review of object oriented software development using the Java programming language. The module is designed to equip students without a computer science (or related) first degree with the appropriate software development capabilities required for the second semester research based modules and when they go on to seek employment within the IT industry. There are 22 lectures and 22 tutorials.

#### ***COMP518 Database and Information Systems***

This module provides a comprehensive review of database and information system techniques. The module is intended for MSc students who do not have a computer science (or related) first degree to provide those students with the appropriate information systems capabilities required for the second semester research based modules, their final individual project and when they go on to seek employment within the IT industry. There are 22 lectures and 22 tutorials.

#### ***COMP519 Web Programming***

This module covers topics such as: distributed systems, WWW and HTML, Applets and the WWW, introduction to Java script, programming in Perl, CGI scripting and protocols. The module is intended for MSc students who do not have a computer Science (or related first degree) to provide those students with the appropriate WWW programming capabilities that they may require to complete their individual project and when they go on to seek employment. There are 26 lectures and 18 tutorials.

#### ***COMP522 Privacy and Security***

This module covers topics such as: identification and authentication, monitoring, protocols, attacks and defences, legal and ethical issues and future directions. There are 30 lectures and 10 tutorials.

#### ***COMP523 Advanced Algorithmic Techniques***

This module covers topics such as: the study of algorithmic problems and techniques on the boundary of current research, dealing with non-standard computational models, graph algorithms, randomised algorithms, on-line algorithms, string algorithms and elements of probabilistic and number theory. There are 30 lectures and 10 tutorials.

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***COMP528 Multi-Core and Multi-Processing Programming***

This module covers theoretical and practical aspects of parallel programming for multi-core architectures with the main focus on hands-on programming experience with latest multi-core and multi-processor platforms. The module was developed in collaboration with STFC Hartree Centre for High-Performance Computing and High-Performance Computing Services of University of Liverpool, whose facilities will be used in the practical sessions of the module. There are 24 lectures and 12 practicals.

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***COMP533 Maths and Statistics for AI and Data Science***

Computer Science in general, and data Science in particular, has its roots in Mathematics. This module is designed to bring you up to speed with the necessary mathematical and statistical underpinning required to study Data Science and AI. The module aims to cover the key concepts and techniques from linear algebra, differential calculus, probability theory and statistics. The acquired knowledge will help you to interpret the results generated during data analysis.

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**Module Descriptions – Semester 2**

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***COMP524 Safety and Dependability***

This module covers topics such as: safety critical systems, security, trusted systems, dependability and reliability, formal requirements engineering, design and development techniques and verification techniques. There are 22 lectures and 20 hours of practical work.

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***COMP526 Applied Algorithmics***

This module covers topics such as: the study of problems with strong algorithmic components, specialised data structures, engineering of algorithms data structures with applications to large data sets, data compression and network algorithms. There are 30 lectures and 10 hours of practical work.

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***COMP527 Data Mining and Visualisation***

This module provides an in-depth, systematic and critical understanding of some of the current research issues at the forefront of the academic research domain of data mining. There are 30 lectures and 10 tutorials.

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***COMP532 Machine Learning and BioInspired Optimisation***

In this module we focus on learning agents that interact with an initially unknown world. Since the world is dynamic this module will put strong emphasis on learning to deal with sequential data unlike many other machine learning courses. This module will cover the following topics: Introduction to parallel problem solving from nature/overview, Reinforcement Learning/Multi-Agent Reinforcement Learning/Replicator Dynamics, Swarm Intelligence: Ant System, Ant Colony Optimization/Bee System/Swarm Robotics, Deep Learning: Restricted Boltzman Machines/Auto-Encoder Networks/Deep Belief Networks, Immune Systems and DNA computing. Lecture slides and reading material will be made available to the students.

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***COMP534 Applied Artificial Intelligence***

This module will provide you with an introduction to key subsets in the field of Artificial Intelligence (AI), including Machine Learning, Deep Learning, Natural Language Processing (NLP) and Computer Vision. To present fundamental problems in all these areas and explain the common methods used to deal with these problems and to develop the practical skills necessary to build AI applications using data from different domains.

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***COMP575 Computational Intelligence***

This module is divided into two parts: (i) Neural Networks and (ii) Evolutionary Computation and Fuzzy Systems. The Neural Network material covered includes the structure of such networks, the learning process (supervised and unsupervised) and applications. Part 2 covers evolutionary methods and optimisation, evolutionary optimisation and genetic algorithms, evolutionary programming, particle swarm intelligence, applications and fuzzy logic systems. This module consists of 24 lectures and 12 tutorials.

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***COMP559 Algorithmic Game Theory***

This module presents an in-depth understanding of the research area of mechanism design which is widely present in the form of dedicated auction protocols used in existing electronic commerce systems. Such systems are implemented and used over the Internet, for instance various banking systems, or many kinds of Internet auctions. The emphasis is put on the algorithmic aspects of these systems where part of the input data (such as customers' preferences) are private data of selfish agents (customers) and the goal of the protocol, called a mechanism, is to efficiently elicit this information from the agents. There are 30 lectures and 10 tutorials.

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**Project**

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***COMP702 MSc Project (60 credits)***

The MSc project leads to the submission of a written dissertation in January when the programme finishes. This will investigate some real application of computing with the object of producing an agreed deliverable, in addition to the dissertation. The project work is usually associated with material covered in the taught research modules making up the programme. Alternatively, students can propose their own projects, or undertake projects based on the needs of local industries, provided that the proposal meets with the academic criteria for an MSc (level M) project.

Members of staff within the Department will manage the project, and students will be required to give regular progress reports and presentations on their work. This is extremely valuable experience, as such presentations are likely to be required in a future career.

Further details of project management, together with details of the projects on offer, will be provided closer to the project start date. There will also be information available on-line nearer the time.