# Programme Specification

## A statement of the knowledge, understanding and skills that underpin a taught programme of study leading to an award from The University of Sheffield

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| **1** | **Programme Title** | Advanced Computer Science |
| **2** | **Programme Code** | COMT123 |
| **3** | **JACS Code** | I100 |
| **4** | **Level of Study** | Postgraduate |
| **5a** | **Final Qualification** | Master of Science (MSc) |
| **5b** | **QAA FHEQ Level** | Masters |
| **6** | **Intermediate Qualification(s)** | Postgraduate Diploma (PGDip), Postgraduate Certificate (PGCert) |
| **7** | **Teaching Institution** (if not Sheffield) | Not applicable |
| **8** | **Faculty** | Engineering |
| **9** | **Department** | Computer Science |
| **10** | **Other Department(s) involved in teaching the programme** | None |
| **11** | **Mode(s) of Attendance** | Full-time |
| **12** | **Duration of the Programme** | 1 year |
| **13** | **Accrediting Professional or Statutory Body** | British Computer Society |
| **14** | **Date of production/revision** | February 2024 |

**15. Background to the programme and subject area**

Computer Science is the fundamental discipline of the information and communication age. Computing now permeates every aspect of life, ranging from business and medicine to science, engineering and the humanities, requiring skilled personnel to harness and exploit the growing power of computing devices.

The MSc in Advanced Computer Science is suited to graduates in Computer Science and related disciplines (such as Software Engineering or Computing and Mathematics) who wish to complete their academic profile in specialist areas, and study in a research-led teaching environment. The programme provides students with an education in leading-edge aspects of computer science, and offers a wide range of elective modules that are informed by the Department's research interests.

The content of the programme reflects the wide range of expertise and research excellence of the Department. Teaching is informed by the research activity of staff, which has an international reputation for the quality of its research. In the 2021 Research Excellence Framework (REF), 99% of our research was rated in the top two categories, meaning it is classed as world-leading or internationally excellent. The Department is rated 8th nationally for the quality of our research environment. In addition to foundational material, the programme allows students to learn about some of the latest developments in the field from staff who publish their research findings world-wide.

The Department's Industrial Advisory Board (a panel of industrial and academic members) plays an important role in advising the Department on its teaching provision, with particular emphasis on the suitability of its degree programmes as training and development for careers in computer science and software engineering.

The programme is accredited by the British Computer Society (BCS), as partially meeting the educational requirements for Chartered Engineer (CEng/IEng) and Chartered Information Technology Professional (CITP) registration.

See the Department of Computer Science website: http://www.shef.ac.uk/dcs for more information.

**16. Programme aims**

The aims of the programme are:

1. To broaden students' knowledge of leading-edge topics in computer science, through the selection of elective modules that can be matched to the students' developing interests and career aspirations.
2. To deepen students' knowledge of selected areas of computer science, through the completion of group and individual project work.
3. To provide immediately employable graduates with an industrially relevant mix of knowledge and practical skills.
4. To provide research training, thus providing a solid foundation for graduates to pursue a research degree or an industrial career in research and development.
5. To immerse students in an academic environment that rewards innovation, fosters a sense of community and encourages students to direct their own learning.

**17. Programme learning outcomes**

| **Knowledge and understanding - On successful completion of the programme, MSc and PG Dip students will:** | |
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| **K1** | Have a sound knowledge and critical understanding of gathering, organising and evaluating information needed to formulate and solve problems. |
| **K2** | Have a thorough academic grounding in the analysis, design, implementation and testing of computer software using modern methods. |
| **K3** | Have a deep academic understanding of several advanced, research-led subject areas, gained by following elective modules. |
| **K4** | Have engaged in a selection of advanced research topics offered annually by the Department of Computer Science's research, to a level commensurate with leading-edge research. |
| **K5** | **(MSc only):** Have a deep knowledge and understanding within the specific subject area of the MSc project and dissertation. |

| **Skills and other attributes - On successful completion of the programme, MSc and PG Dip students will:** | |
|---|---|
| **S1** | Be able to function in a computer-based learning environment, making full use of email, the internet and electronic media. |
| **S2** | Be able to conceive, design and write correct working computer programs in the object-oriented paradigm. |
| **S3** | Have written communication skills, including the ability to comprehend, summarise, synthesize and properly cite research-level material as part of an integrated argument. |
| **S4** | Have oral communication skills, specifically the ability to present and defend a substantial piece of work, to engage with enquirers and respond effectively to questions. |
| **S5** | Have team working skills, demonstrating personal responsibility and group management ability, interpersonal communication skills, leadership and delegation, and the ability to plan to meet deadlines. |
| **S6** | Have research skills, demonstrating an ability to identify material from multiple published sources, relevant to a chosen topic, and from it synthesize theories, principles or designs pertinent to a practical, problem-solving project. |
| **S7** | Be able to demonstrate project planning and management skills, fostered through the completion of a practical, problem-solving group project with a research dimension. |
| **S8** | **(MSc only):** Be able to demonstrate initiative and self-motivation, fostered through the completion of an individual project. |

**18. Teaching, learning and assessment**

**Development of the learning outcomes is promoted through the following teaching and learning methods:**

Learning is student-centred, that is, the Department fosters an environment with many opportunities for individual and group learning, but the responsibility for learning rests with the student, who must be personally organised and self-motivated to make the most of the programme. Students are assigned to a personal tutor; they meet regularly to discuss progress and learning issues. Academic and technical advice may be sought from lecturers, teaching assistants and supporting staff (initially, via email). Teaching is offered through induction procedures, formal lectures, seminars, computer laboratories, problem-solving classes and project supervision.

**Induction procedures** in which students are provided with an introduction pack and participate in tutorial sessions. Contents of the pack include the MSc Student Handbook, and a departmental map enabling students to familiarise themselves with the layout of the department and the main computing facilities. During intro week, students participate in tutorials that introduce them to the resources available via the departmental web site and local intranet. Learning outcomes *K1* and *S1* are supported through this.

**Lectures** are 50-minute formal presentations to a large class of students by a lecturer, who is responsible for the delivery of the module concerned. The purpose of a lecture is to motivate interest in a subject, to convey the core concepts and information content succinctly and to point students towards further sources of information. Lectures are interactive and students are encouraged to ask questions at suitable points. Students are expected to take notes during lectures, adding detail to published course materials. The learning outcomes *K1-K4* are supported mainly through this mode.

**Seminars** are longer 90- to 110-minute informal presentations to a class of students by a lecturer, researcher, industrial partner or student, describing an area of their current research or business. There is typically more opportunity to structure the session internally with questions, problem solving and other kinds of interactive or shared learning experience, in which the students may also participate in the teaching. The learning outcomes *K4*, *S5* and *S6* are directly promoted through this mode, with indirect support for *S4* and *K1-K3.*

**Computer laboratories** are 50-minute or 110- minute sessions, supervised by teaching assistants (and sometimes attended by the responsible lecturer) in which students work at a computer, to learn and practise a specific practical skill such as computer programming. The learning outcomes *S1* and *S2* are promoted mainly through this mode, with indirect support for *K1-K4*.

**Problem-solving classes** are 50-minute sessions conducted by a lecturer with a class of students, in which exercises are completed interactively and solutions are provided within the period. The purpose of such a class is to help students engage practically with material presented in lectures and start to apply this knowledge. The learning outcomes *K1-K4* are supported through this mode.

**Project supervision** is a regular meeting held with an individual or group project supervisor, who may also be the student's personal tutor. During the 20-50 minute session, students report on their progress to the supervisor, who highlights further areas of investigation, helps with technical problems, advises about the content and structure of technical reports and generally encourages the students to organise their time effectively. The learning outcomes *S4-S7* and *K5* are directly promoted through this mode, with *S2* and *S3* supported indirectly.

The transition from teaching to self-motivated learning is encouraged through specialist teaching materials such as lecture handouts or copies of lecture slides, which are typically supplied via the Department of Computer Science website. Set course texts and more general background materials are available through the University libraries, at bookshops and also via the Internet. Students are responsible for obtaining textbooks and printing any material downloaded over the Internet. Active learning is fostered and promoted through engagement in practical work, such as exercises, assignments and projects. Additionally, students are expected to undertake private study.

**Exercises** are short tasks, either writing computer programs or working out solutions to other kinds of set problem, which are typically reviewed at the end of the session. Learning outcomes *K1-K4* and *S1-S3* may be supported this way.

**Assignments** are offered over several weeks, typically involving the design and implementation of a software system to perform a given task, or the researching of a body of information leading to the writing of a discursive essay on a given topic. Learning outcomes *K1-K4* and *S2-S4* are supported by this.

**Projects** are undertaken individually or in groups over one or two semesters. Projects typically solve a larger problem, possibly for an industrial client, possibly with a research dimension, and require good personal and organisational skills and good presentation skills. Learning outcomes *K5* and *S2-S7* are supported by this;

indirectly, *S1* and *K1-K4* are reinforced.

**Private study** makes up more than half of the time allocated to each module. Students are expected to read around the topics of each module and follow directed reading from recommended course texts. Private study will include further investigations prior to exercises or projects and consolidates the lecture notes.

**Opportunities to demonstrate achievement of the learning outcomes are provided through the following assessment methods:**

Modules may be assessed by examination, by an individual or group project, or by some combination of examination and a practical assignment. Learning outcomes *K1-K4* and S2-S4 may be assessed by examination or coursework. Learning outcome *S1* is not formally assessed, but is a skill acquired as a side-effect of working in a computer-based learning environment. Learning outcomes *K5* and *S4-S7* are assessed by individual and group project work.

**Examinations** are typically 2-hour question papers. Examinations test the knowledge learning outcomes *K1-K4*, but also provide evidence of practical skill *S3*, and evidence of previous engagement in *S2*.

**Assignments** are pieces of continuously assessed coursework, which students complete individually or in groups as directed. Assignments both develop and assess the practical skills *S2-S4* (and *S5* for group assignments).

An **individual project** is completed during the summer. Students select a topic, research the background literature, prepare a survey/analysis report at the interim assessment stage, and apply this knowledge in a practical, problem-solving project which is expected to contain some degree of original contribution. The final assessment stage is by dissertation and poster session (including a software demonstration, if appropriate), assessed independently by two examiners. A *viva voce* examination may be held to form a common view in cases of insufficient evidence or divergent opinions. The learning outcomes *K5*, *S3-S4* and *S7* are directly assessed, together with specialist areas of knowledge from *K2-K4*. Practical skills in *S1-S4* may be assessed indirectly.

## 19. Reference points

**The learning outcomes have been developed to reflect the following points of reference:**

**Internal**

University Strategic Plan
http://www.sheffield.ac.uk/strategicplan

Teaching and Learning Strategy of the Department of Computer Science;

Discussions with past and present members of the Department of Computer Science Industrial Advisory Board (consisting of representatives from major companies in the IT industry, as well as more specialist consultancies and companies).

Departmental annual student course evaluations and student feedback via the Staff-Student Liaison Committee.

**External**

Subject Benchmark Statements
https://www.qaa.ac.uk/the-quality-code/subject-benchmark-statements

Framework for Higher Education Qualifications
https://www.qaa.ac.uk/the-quality-code/qualifications-frameworks

The UK Standards for Professional Engineering Competence (UK-SPEC), Third Edition, 2013.

Accreditation of Higher Educations Programmes (AHEP), Third Edition (2013).
Guidelines for accreditation by the British Computer Society (BCS)

Visiting accreditation panel of the British Computer Society (BCS) in 2022.

Peer review by a senior academic from a UK research-led University.

The workload fits comfortably within the guidelines laid down by the University, and is monitored by *external examiners*, who also review the content and standard of the programme.

**20. Programme structure and regulations**

The programme is offered over 12 months, starting in late September each year, and finishing the following September. The teaching year is divided into two semesters of 15 weeks, plus a 12-week project period during the summer. The first 12 weeks of each semester are devoted to teaching, with the remaining 3 weeks devoted to examinations. The programme is fully modular, delivered typically in units of 15 or 30 credits. Masters' students' study for 180 credits in a year (120 credits of taught modules and a 60 credit dissertation).

The **core** modules consist of 45 credits (15 credits each):

- COM6516 Object Oriented Programming and Software Design (promoting K2, S2, S4)
- COM6103 Team Software Project (promoting K1, K2, S1, S5, S7)
- COM6655 Professional Issues

The **elective** modules consist of 75 credits chosen from the following topics (15 credits each), all of which promote K1, K3, K4, S1:

- COM6502 Speech Processing (also promotes K2)
- COM6511 Speech Technology (also promotes K2)
- COM6115 Text Processing (also promotes K2)
- COM6513 Natural Language Processing (also promotes K2)
- COM6503 3D Computer Graphics (also promotes K2, S2)
- COM6509 Machine Learning and Adaptive Intelligence (promoting K1-K4, S1)
- COM6510 Software Development for Mobile Devices (also promotes K2, S2, S3, S5, S7)
- COM6521 Parallel Computing with Graphical Processing Units (GPUs) (also promotes K2)
- COM6504 The Intelligent Web (also promotes K2)
- COM6009 Modelling and Simulation of Natural Systems (also promotes K2)
- COM6506 Testing and Verification in Safety Critical Systems
- COM6507 Software and Hardware Verification (also promotes K2, S3, S4)
- COM6116 Theory of Distributed Systems
- COM6515 Network Performance Analysis
- COM6523 Software Reengineering

The **dissertation** project consists of one module (60 credits):

- COM6906 Dissertation Project (promoting K1, K4, K5, S1, S3, S4, S6, S8)

Students who obtain 180 credits in total are awarded the degree of MSc. Exit awards of PG Diploma and PG Certificate can also be awarded to students who have obtained the appropriate number of credits as stated in the University regulations.

Detailed information about the structure of programmes, regulations concerning assessment and progression and descriptions of individual modules are published in the University Calendar available on-line at http://www.sheffield.ac.uk/calendar/

**21. Student development over the course of study**

Students progress through two semesters of taught modules (in which they acquire knowledge and skills) to the individual project (in which they apply the knowledge and skills previously learned).

Students entering the programme will typically possess a first degree in Computer Science, Software Engineering, Computing and Mathematics or a related discipline. However, students' experience in their undergraduate programmes will vary (for example, they may not have prior experience of group working). Hence, the programme contains core modules which cover the foundations of software engineering, team working and research techniques. The core modules ensure that all students have a common academic grounding, and emphasize fundamental principles, concepts and techniques. Student choice is served through the availability of a wide selection of elective modules, designed to enable students to design a programme in accordance with their developing interests and career aspirations.

Students' development over the course of their study is measured through assessment of performance in each module, and monitored via regular meetings with a personal tutor who also offers pastoral care.

Masters students are required to complete a research-based dissertation of approximately 15,000 – 20,000 words. This enables students to apply appropriate research techniques to a real problem in the field of computer science, and to engage at an in-depth level with an area of the subject which is of particular interest to them. Students may develop their own dissertation topics, in consultation with staff, or select from a list of possible topics generated by academic staff and industrial clients.

PG Diploma and PG Certificate students do not complete a dissertation project, hence learning outcomes K5 and S8 do not apply. In addition, PG Certificate students will have successfully completed fewer modules than MSc or PG Diploma students and are therefore expected to have an appreciation of some learning outcomes (K2-K4) rather than a thorough understanding of them.

**22. Criteria for admission to the programme**

Detailed information regarding admission to the programme is available at http://www.sheffield.ac.uk/dcs/postgraduate-taught

A candidate for this programme will typically be a graduate in Computer Science, Software Engineering or Computing and Mathematics who expects to pursue a research career. Students whose first language is not English must hold an approved English language qualification.

**23. Additional information**

The Department of Computer Science is housed in the modern, purpose-built Regent Court building and has its own dedicated computing facilities. The Department is internationally recognised for its teaching and research (in the 2021 Research Excellence Framework (REF), 99% of our research was rated in the top two categories, meaning it is classed as world-leading or internationally excellent). It has particular research strengths in the fields of natural language processing, speech technology, machine learning, robotics, computer graphics and software verification and testing.

The Department of Computer Science MSc Student Handbook governs all local aspects of academic student life, with regard to services offered, computer etiquette, and local regulations.

This specification represents a concise statement about the main features of the programme and should be considered alongside other sources of information provided by the teaching department(s) and the University. In addition to programme specific information, further information about studying at The University of Sheffield can be accessed via our Student Services web site at http://www.sheffield.ac.uk/ssid.