

Computer Systems Engineering BEng (Hons) 2012-2013 Summary

| UCAS code | Award | Title | Duration | Mode |
|-----------|-------|--|----------|------|
| HH66 | BEng | Computer Systems Engineering BEng (Hons) | 3 years | FT |

| | |
|---------------------------|-----------------------------------|
| Schools | Computer Science |
| Faculty | Engineering and Physical Sciences |
| Awarding Institution | University of Manchester |
| Programme Accreditation | BCS, IET |
| Relevant QAA benchmark(s) | Computing |

Aims and intended learning outcomes

Sophisticated electronic systems permeate all aspects of life. Typical examples include MP3 players, games consoles, mobile phones, vehicle control systems and radar. All of these are embedded systems, which typically contain one or more microprocessors, memory, a communications capability, and application-specific hardware and software. Our Computer Systems Engineering programmes aim to develop the wide range of knowledge and skills are needed to support their development, including digital electronics, software engineering and computer architecture.

Our programmes aim to:

- 1) enable graduates to exhibit a high level of practical and theoretical skills over a broad range of Computer Science together with a knowledge of currently available techniques and technologies.
- 2) explore the principles that support developments in a rapidly changing subject.
- 3) provide opportunities for students to understand the wide range of research challenges facing Computer Science, as well as the breadth and depth of research undertaken in this top-rated school, so they are prepared to embark on research here or elsewhere.
- 4) develop competent professionals able to play a leading part in many different commercial, industrial and academic activities and adapt rapidly to changing technology.
- 5) meet industry demand for high calibre graduates who will take a lead in continuing technological change.
- 6) prepare students for the social, organisational and professional context in which they will be working.
- 7) meet the educational requirements of the Engineering Council thus enabling graduates to progress to professional membership of the BCS and IET and attain the highest professional status of Chartered Engineer.
- 8) In addition, the with Industrial Experience programmes aim to: give extensive practical experience of an industrial or business environment where students are able to apply and develop their skills, both technical and personal.
- 9) In addition, the MEng programmes aim to: prepare high fliers for professional practice in Computer Science by enhanced depth and breadth of study together with increased emphasis on industrial relevance through industrially related group projects.

Intended learning outcomes

Knowledge & understanding

- A1 Know and understand the essential mathematics relevant to computer science.
- A2 Understand and apply a wide range of principles and tools available to the software engineer, such as design methodologies, choice of algorithm, language, software libraries and user interface techniques
- A3 Demonstrate a grasp of the principles of computer systems, including architecture, networks and communication
- A4 Recognise and appreciate the professional and ethical responsibilities of the practising computer professional, including understanding the need for quality
- A5 Know and understand the principles and techniques of a number of application areas informed by the research directions of the subject, such as artificial intelligence, databases and computer graphics
- A6 Apply their knowledge of computing in a commercial or industrial context
- A7 Show a critical understanding of the broad context within which Computer Science resides, including issues such as quality, reliability, enterprise, employment law, accounting and health and safety
- A8 Have a comprehensive knowledge and critical awareness of selected specialist fields at the forefront of computer science, studied at masters level

Intellectual (thinking) skills

- B1 Solve a wide range of problems related to the analysis, design and construction of computer systems.
- B2 Design and implement a software or hardware system of significant size

- B3 Identify a range of solutions and critically evaluate and justify proposed design solutions
- B4 Solve computer science problems with pressing commercial or industrial constraints
- B5 Generate an innovative design to solve a problem containing a range of commercial and industrial constraints

Practical skills

- C1 Plan and undertake a major individual project
- C2 Prepare and deliver coherent and structured verbal and written technical reports
- C3 Give technical presentations suitable for the time, place and audience
- C4 Use the scientific literature effectively and make discriminating use of Web resources
- C5 Design, write and debug computer programs in appropriate languages
- C6 Use appropriate computer-based design support tools
- C7 Apply computer science skills in a commercial or industrial environment
- C8 Demonstrate initiative taking, innovation and self-management in an industrially related group project
- C9 Integrate previously acquired skills and apply them to new, demanding situations

Transferable skills

- D1 Display an integrated approach to the deployment of communication skills
- D2 Use IT skills and display mature computer literacy
- D3 Work effectively with and for others
- D4 Strike the balance between self-reliance and seeking help when necessary in new situations
- D5 Display personal responsibility by working to multiple deadlines in complex activities
- D6 Employ discrete and continuous mathematical skills as appropriate
- D7 Demonstrate significantly enhanced group working abilities
- D8 Further develop career plans and personal objectives
- D9 Communicate effectively with non-specialist as well as computer scientist professionals at a range of levels
- D10 Undertake a range of technical roles within a team and be able to display leadership

Teaching, learning and assessment methods

Learning and Teaching on all our programmes aims to combine an understanding of fundamental CS principles, development of strong practical skills and the group-working, learning and communication skills that are essential for any computing professional.

Course units which involve practical elements all have associated laboratory exercises, usually in timetabled sessions with staff and demonstrator support. Most labs operate a system of face-to-face marking in the lab so that students receive immediate feedback on their work. Units without labs all have regular coursework exercises to support skills development and feedback.

Most units are lecture based, with lab or coursework exercises used to reinforce and enhance knowledge and skills first encountered in lectures. The first year team project deviates significantly from this model and takes an Enquiry Based Learning approach. This unit aims to encourage students to be more actively engaged with, and responsible for, their own learning, to develop skills in problem solving, communication, independent learning, and group work, and to signal the importance we attach to independent learning. This approach is followed up in the second year with the workshop based approach used in the compulsory Software Engineering unit, which also contains a major group working component.

The choice of units offered to students on our programmes is very broad, but they also require depth in particular subject areas. This is achieved using the notion of Themes. . A theme is a group of related second and third year course units which form a coherent whole; usually one second year and two third year units. All single honours students are required to complete at least two themes; those on the Computer Science programme can choose any pair of themes, but those on specialist programmes must complete at least two themes associated with their specialism. It is the choice of these themes that characterises the specialist programmes. The Programme Structure section below indicates the Themes for this group of programmes and the tables in that section show the Theme for each course unit.

All students undertake an individual 3rd year project, supervised by a member of academic staff, which usually involves the development of significant software or hardware product. Assessment of this unit involves presentations of plans and results and a major written report

Assessment in almost all units is a combination of lab/coursework and examination.

Learning, Teaching and Assessment of intended learning outcomes

Knowledge and Understanding

| Learning and Teaching Processes | Assessment |
|---|--|
| Lectures (A1, A2, A3, A4, A5, A6, A7) | Unseen written examinations (A1, A2, A3, A4) |
| Laboratory sessions (A2, A3) | Marked tutorial exercises (A1, A2, A3, A4) |
| Personal tutorials (A1, A2, A3, A4, A7) | Laboratory reports (A2, A3) |
| Problem solving classes (A1, A2, A3, A4) | Project reports (individual and group) (A3, A4, A5, A6, A7) |
| Problem-based learning (A2, A3, A4, A5, A6, A7) | Oral presentations (individual and group) (A3, A4, A5, A6, A7) |
| Projects (A3, A4, A5, A6, A7) | |
| Industrial seminars (A4, A5, A6, A7) | |

Intellectual Skills

| Learning and Teaching Processes | Assessment |
|--------------------------------------|--|
| Lectures (B1, B2, B4, B5) | Unseen written examinations (B1, B2, B4) |
| Laboratory sessions (B1, B2) | Marked tutorial exercises (B1, B2) |
| Personal tutorials (B1, B2, B4) | Laboratory reports (B1, B2) |
| Problem solving classes (B1, B2, B4) | Project reports (individual and group) (B1, B2, B3, B4, B5) |
| Problem-based learning (B1, B2, B4) | Oral presentations (individual and group) (B1, B2, B3, B4, B5) |
| Projects (B1, B2, B3, B4, B5) | |

Practical Skills

| Learning and Teaching Processes | Assessment |
|--|---|
| Lectures (C4, C6) | Laboratory reports (C1, C2, C3, C4, C5, C6, C7) |
| Laboratory sessions (C1, C2, C3, C4, C5, C6, C7) | Project reports (individual and group) (C3, C4, C5, C6) |
| Projects (C3, C4, C5, C6, C9) | Oral presentations (individual and group) (C6, C8, C9) |

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|------------------------------|--|--------------------------------------|
| Industrial placement (C8,C9) | | Industrial placement reports (C8,C9) |
|------------------------------|--|--------------------------------------|

Transferable skills

| Learning and Teaching Processes | | Assessment |
|---|--|--|
| Lectures (D3, D4, D5, D7) | | Laboratory reports (D1, D3, D5, D6) |
| Laboratory sessions (D1, D3, D5, D6) | | Essays (D2, D3) |
| Personal tutorials (D1,D2, D3, D4, D7) | | Project reports (individual and group) (D1, D2, D3,D4, D5, D6, D7) |
| Problem solving classes (D4) | | Oral presentations (individual and group) (D1, D3, D6, D7, D8) |
| Problem-based learning (D1, D2, D3, D4, D5, D6) | | Industrial placement reports (D8) |
| Projects (D1, D2, D3, D4, D5, D6, D7) | | |
| Industrial placement (D8) | | |

Programme structure

Level 1 - compulsory units

All of the units in this pool are mandatory.

| Code | Title | Credits |
|-----------|--|---------|
| COMP10120 | First Year Team Project | 20 |
| COMP11120 | Mathematical Techniques for Computer Science | 20 |
| COMP11212 | Fundamentals of Computation | 10 |
| COMP12111 | Fundamentals of Computer Engineering | 10 |
| COMP14112 | Fundamentals of Artificial Intelligence | 10 |
| COMP15111 | Fundamentals of Computer Architecture | 10 |
| COMP16121 | Object Oriented Programming with Java 1 | 20 |
| COMP16212 | Object Oriented Programming with Java 2 | 10 |
| COMP18112 | Fundamentals of Distributed Systems | 10 |

Level 2 options

This programme requires 2 themes to be completed from the following list.

- * Computer Architecture (COMP25111, COMP25212 & COMP35112)
- * System-on-Chip (COMP22111, COMP32111 & COMP32212)

Level 2 - compulsory units

All of the units in this pool are mandatory.

| Code | Title | Credits | Theme |
|-----------|---------------------------------------|---------|--------------------------------|
| COMP22111 | Processor Microarchitecture | 10 | System-on-Chip |
| COMP22712 | Microcontrollers | 10 | None |
| COMP23111 | Fundamentals of Databases | 10 | Enterprise Information Systems |
| COMP23420 | Software Engineering | 20 | Software Engineering |
| COMP25111 | Operating Systems | 10 | Computer Architecture |
| COMP25212 | System Architecture | 10 | Computer Architecture |
| COMP26120 | Algorithms and Imperative Programming | 20 | Programming and Algorithms |
| COMP28512 | Mobile Systems | 10 | Mobile Computing and Networks |

Level 2 - option pool 1

From this option pool choose 10 credits.

| Code | Title | Credits | Theme |
|-----------|-----------------------------------|---------|--|
| COMP21111 | Logic and Modelling | 10 | Rigorous Development |
| COMP24111 | Machine Learning and Optimisation | 10 | Learning and Search in Artificial Intelligence |
| COMP28411 | Computer Networks | 10 | Mobile Computing and Networks |
| MLPX20021 | Leadership in Action | 10 | None |

Level 2 - option pool 2

From this option pool choose 10 credits.

| Code | Title | Credits | Theme |
|-----------|--|---------|--|
| COMP24412 | Symbolic AI | 10 | Natural Language, Representation and Reasoning |
| COMP27112 | Computer Graphics and Image Processing | 10 | Visual Computing |
| COMP28112 | Distributed Computing | 10 | Web and Distributed Systems |
| HSTM20282 | The Information Age | 10 | None |
| MLPX20022 | Leadership in Action | 10 | None |

Level 3 options

From the optional lists you must choose 30 credits from semester one and 30 credits from semester two.
This programme requires 2 themes to be completed from the following list.

- * Computer Architecture (COMP25111, COMP25212 & COMP35112)
- * System-on-Chip (COMP22111, COMP32111 & COMP32212)

Level 3 - compulsory units

All of the units in this pool are mandatory.

| Code | Title | Credits | Theme |
|------|-------|---------|-------|
|------|-------|---------|-------|

| | | | |
|-----------|--|----|-----------------------|
| COMP30040 | 3rd Year Project (Single Honours 40 Credits) | 40 | None |
| COMP32111 | System-on-chip Modelling with SystemC | 10 | System-on-Chip |
| COMP32212 | Implementing System-on-Chip Designs | 10 | System-on-Chip |
| COMP35112 | Chip Multiprocessors | 10 | Computer Architecture |

Level 3 - option pool 1

From this option pool choose a maximum of 20 credits and a minimum of 10 credits.

| Code | Title | Credits | Theme |
|-----------|-------------------------------------|---------|--|
| COMP31111 | Verified Development | 10 | Rigorous Development |
| COMP33111 | Data Integration and Analysis | 10 | Enterprise Information Systems |
| COMP33411 | Software Design using Patterns | 10 | Software Engineering |
| COMP34411 | Natural Language Systems | 10 | Natural Language, Representation and Reasoning |
| COMP36111 | Advanced Algorithms I | 10 | Programming and Algorithms |
| COMP36411 | Understanding Programming Languages | 10 | Computer Languages |
| COMP37111 | Advanced Computer Graphics | 10 | Visual Computing |
| COMP38411 | Cryptography and Network Security | 10 | Mobile Computing and Networks |

Level 3 - option pool 2

From this option pool choose a maximum of 30 credits and a minimum of 20 credits.

| Code | Title | Credits | Theme |
|-----------|---|---------|--------------------------------|
| COMP31212 | Concurrency and Process Algebra | 10 | Rigorous Development |
| COMP33212 | Advanced Database Systems | 10 | Enterprise Information Systems |
| COMP33512 | User Experience | 10 | Software Engineering |
| COMP33812 | Software Evolution | 10 | Agile Methods |
| COMP36212 | Advanced Algorithms II | 10 | Programming and Algorithms |
| COMP36512 | Compilers | 10 | Computer Languages |
| COMP37212 | Computer Vision | 10 | Visual Computing |
| COMP38212 | Topics in Advanced Information Retrieval | 10 | Web and Distributed Systems |
| COMP38512 | Digital Wireless Communication and Networks | 10 | Mobile Computing and Networks |

Level 3 - option pool 3

From this option pool choose a maximum of 20 credits and a minimum of 0 credits.

| Code | Title | Credits | Theme |
|-----------|---|---------|-------|
| HSTM20282 | The Information Age | 10 | None |
| MLPX20021 | Leadership in Action | 10 | None |
| MLPX20022 | Leadership in Action | 10 | None |
| MSEC31122 | Managing Finance in Enterprises for Computer Scientists | 10 | None |
| MSEC31131 | Enterprise Management for Computer Scientists | 10 | None |

| Code | Title | C/O | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | B1 | B2 | B3 | B4 | B5 | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | |
|-----------|--|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|----|
| COMP10120 | First Year Team Project | C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| COMP11120 | Mathematical Techniques for Computer Science | C | DA | | | | | | | | DA | | | | | | | | | | | | | | | | | | | | | | | | |
| COMP11212 | Fundamentals of Computation | C | DA | | | | | | | | DA | | | | | | | | | | | | | | | | | | | | | | | | |
| COMP12111 | Fundamentals of Computer Engineering | C | D | D | | | | | | | D | D | D | | | | | | | D | | | | | | | | | | | | | | | |
| COMP14112 | Fundamentals of Artificial Intelligence | C | D | D | | D | D | | | | D | D | | | | | | | | D | | | | | | | D | D | D | | | | | | |
| COMP15111 | Fundamentals of Computer Architecture | C | | | DA | | | | | | | | | | | | | | | D | D | | | | | | | | | | | | | | |
| COMP16121 | Object Oriented Programming with Java 1 | C | | DA | | | | | | | | | | | | | | | | DA | | | | | | | | DA | DA | | | | | | |
| COMP16212 | Object Oriented Programming with Java 2 | C | | DA | | | | | | | DA | DA | DA | | | | | | D | DA | | | | | | | D | D | D | | | | | | |
| COMP18112 | Fundamentals of Distributed Systems | C | | DA | | | | | | | | | DA | | | | | | | | | | | | | | | | | | | | | | |
| COMP21111 | Logic and Modelling | O | D | D | | | D | | | | D | | | | | | | | | D | | | | | | | | | | | | | | | |
| COMP22111 | Processor Microarchitecture | C | | | DA | | | | | | DA | DA | DA | | | DA | DA | | | DA | DA | | | | | | | DA | DA | | | | | | |
| COMP22712 | Microcontrollers | C | | D | D | | | | | | | D | D | | | | | | | D | D | | | | | | | D | D | | | | | | |
| COMP23111 | Fundamentals of Databases | C | | | | D | DA | | D | | DA | | DA | | | | | DA | | | | | | | DA | | DA | | DA | | | | | | |
| COMP23420 | Software Engineering | C | | D | | D | | | | | D | D | D | | | | | D | | D | D | D | | | | D | D | D | D | | | | | | |
| COMP24111 | Machine Learning and Optimisation | O | DA | | DA | | | | | | | | DA | | | | | | DA | DA | | | | | | | | | | | | | | | DA |
| COMP24412 | Symbolic AI | O | DA | | | | DA | | | | D | | | | | | | | | D | | | | | | D | | | | | | | | | D |
| COMP25111 | Operating Systems | C | | D | D | | | | | | D | D | D | | | D | | | | D | | | | | D | | | D | D | | | | | | |
| COMP25212 | System Architecture | C | | | DA | | | | | | DA | DA | DA | | | | | | | DA | | | | | | | | | | | | | | | |
| COMP26120 | Algorithms and Imperative Programming | C | | DA | DA | DA | | | | | DA | DA | DA | | | | | | DA | DA | DA | | | | | DA | | DA | DA | DA | DA | | | | |
| COMP27112 | Computer Graphics and Image Processing | O | DA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | DA |
| COMP28112 | Distributed Computing | O | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| COMP28411 | Computer Networks | O | | | D | | | | | | D | | | | | | | | | D | D | | | | | | | D | D | D | | | | | |
| COMP28512 | Mobile Systems | C | | DA | DA | | DA | | | | DA | DA | DA | | | | | DA | DA | | | | | | DA | | DA | | | | | DA | | | DA |

Mechanisms for programme revision

Course units are reviewed annually by the Undergraduate Committee, as part of the Annual Review process, taking into account the results and comments from Course Unit Evaluation Questionnaires. Input is also received from the Teaching Assessment Panel, which has a responsibility for monitoring teaching quality in the School.

Programmes have been reviewed regularly by groups created specifically for this purpose; the last major review resulted in a new programme portfolio design which started in the first year in 2008-9. The responsibility for leadership of programme review is now in the hands of the Director of Teaching Strategy (currently Dr Steve Pettifer) who chairs a School Teaching Strategy Committee.