Computer Systems Engineering BEng (Hons) 2020-2021

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	Unversity 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 ofThemes. . 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 task, 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)

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

You will be automatically enrolled on these nine course units which total 120 credits.

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
COMP15111	Fundamentals of Computer Architecture	10
COMP13212	Data Science	10
COMP15212	Operating Systems	10
COMP16321	Introduction to Programming 1	20
COMP16412	Introduction to Programming 2	10

Level 2 options

You will be automatically enrolled on these seven course units which total <u>90 credits</u>

You need to select a minimum of one course unit totalling 10 credits or a maximum of two course units totalling <u>20 credits</u> from Option Pool 1. You may select a minimum of zero course units or a maximum of one course unit totalling <u>10 credits</u> from Option Pool 2. You may choose a maximum of <u>10 credits</u> of external units from External Option Pool 1 and a maximum of <u>10 credits</u> of external units from External Option Pool 2.

You can choose up to <u>20 credits</u> of optional course units that are external to the Department. You can choose any Level 1 or 2 options for which you meet any pre-requisites and fits with your timetable, these may be:

- Business and Management course units: https://www.ambs.ughandbook.manchester.ac.uk/non-ambs-students/
- University College course units
- Language course units: https://www.alc.manchester.ac.uk/study/university-language-centre-leap-courses/course-information/leap-courses/courses-for-all/
- HSTM20282 Information Visions https://www.manchester.ac.uk/study/undergraduate/courses/2021/00485/bsc-biology-with-science-and-society/course-details/HSTM20282#course-unit-details

Please note: to enrol on some external course units (such as Language) will require permission from the associated School/Department.

To select any external course units outside of the list given above will require permission from the 2nd Year Tutor.

If you take a <u>20 credit</u> whole year course unit you are not permitted to drop this unit when course unit selection reopens at the start of semester 2.

You must ensure your credits are balanced over the academic year (<u>60 credits</u> in each semester).

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

* Computer Architecture (COMP25111, COMP25212 & COMP35112)
* System-on-Chip (COMP22111 & COMP32211)

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
COMP23311	Software Engineering 1	10	Agile Methods
COMP23412	Software Engineering 2	10	Agile Methods
COMP25212	System Architecture	10	Computer Architecture
COMP26120	Algorithms and Data Structures	20	Computer Languages
COMP26020	Programming Languages & Paradigms	20	None

Level 2 - option pool 1

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

Code	Title	Credits	Theme
COMP21111	Logic and Modelling	10	Rigorous Development
COMP23111	Database Systems	10	Web and Distributed Systems
COMP24011	Introduction to AI	10	None

Level 2 - option pool 2

From this option pool choose a maximum of 10 credits
and a minimum of 0 credits.

Code	Title	Credits	Theme
COMP24112	Machine Learning	10	None
COMP24412	Knowledge Based AI	10	Natural Language, Representation and Reasoning
COMP27112	Introduction to Visual Computing	10	Visual Computing
COMP28112	Distributed Systems	10	Web and Distributed Systems

Level 3 options

You will be automatically enrolled on three course units, including the Third Year Project course unit, totalling <u>60 credits.</u>

You need to select a minimum of one course unit totalling <u>10 credits</u> or a maximum of three courses totalling 30 credits from Option Pool 1. You need to select a minimum of one course totalling <u>10 credits</u> or a maximum of three courses totalling 30 credits from Option Pool 2. You may choose a maximum of <u>10 credits</u> of external units from External Option Pool 1 and a maximum of <u>10 credits</u> of external units from External Option Pool 2. You may choose a maximum of <u>20 credits</u> of BMAN30010. Please note that as this is a year-long course unit if you take this in semester one you must continue in semester 2.

You can also choose up to <u>20 credits</u> of optional course units that are external to the Department. You can choose any Level 2 or 3 options for which you meet any pre-requisites and fits with your timetable, these may be:

- Business and Management course units: https://www.ambs.ughandbook.manchester.ac.uk/non-ambs-students/
- University College course units
- Language course units: https://www.alc.manchester.ac.uk/study/university-language-centre-leap-courses/course-information/leap-courses/courses-for-all/
- HSTM20282 Information Visions https://www.manchester.ac.uk/study/undergraduate/courses/2021/00485/bsc-biology-with-science-and-society/course-details/HSTM20282#course-unit-details

Please note: to enrol on some external course units (such as Language) will require permission from the associated School/Department.

To select any external course units outside of the list given above will require permission from the 3rd Year Tutor.

You must ensure your credits are balanced over the academic year (<u>60 credits</u> in each semester).
This programme requires 2 themes to be completed from the following list.

* Computer Architecture (COMP25111, COMP25212 & COMP35112)
* System-on-Chip (COMP22111 & COMP32211)

Level 3 - compulsory units

All of the units in this pool are mandatory.

Code	Title	Credits	Theme
COMP30040	Third Year Project Laboratory	40	None
COMP32211	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 30 credits
and a minimum of 10 credits.

Code	Title	Credits	Theme
COMP33511	User Experience	10	Interactive Systems Design
COMP36111	Algorithms and Complexity	10	Programming and Algorithms
COMP36511	Compilers	10	None
COMP37111	Advanced Computer Graphics	10	Visual Computing
COMP38411	Cryptography and System Security	10	Mobile Computing and Networks
COMP38211	Documents and Data on the Web	10	None

Level 3 - option pool 2

From this option pool choose a maximum of 30 credits and a minimum of 10 credits.

Code	Title	Credits	Theme
COMP33712	Agile Software Engineering	10	None
COMP34412	Natural Language Systems	10	Natural Language, Representation and Reasoning
COMP36212	Mathematical Systems and Computation	10	Programming and Algorithms
COMP37212	Computer Vision	10	Visual Computing
COMP32412	The Internet of Things: Architectures and Applications	10	Web and Distributed Systems
COMP34212	Cognitive Robotics	10	None

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
COMP34120	AI and Games	20	Learning and Search in Artificial Intelligence

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			DA	D					DA	DA					DA	DA	D	DA				DA		DA	DA	DA	DA		DA		D	DA
COMP11120	Mathematical Techniques for Computer Science	C	DA								DA																			DA				
COMP11212	Fundamentals of Computation	C	DA								DA																							
COMP12111	Fundamentals of Computer Engineering	C	D																															
COMP13212	Data Science	C																																
COMP15111	Fundamentals of Computer Architecture	C			DA						DA									DA														
COMP15212	Operating Systems	C			D				D		D		D																					
COMP16321	Introduction to Programming 1	C																																
COMP16412	Introduction to Programming 2	C																																
COMP21111	Logic and Modelling	O	D	D			D				D									D														
COMP22111	Processor Microarchitecture	C	D																										D					
COMP22712	Microcontrollers	C		D	D							D	D							D	D							D	D					
COMP23111	Database Systems	O				D	DA		D		DA		DA				DA								DA		DA		DA					
COMP23311	Software Engineering 1	C		DA		DA		DA				D	DA	DA	DA					DA	D			DA			DA							
COMP23412	Software Engineering 2	C	D	D	D		DA	D			D	DA	D	D	DA	DA			DA	D	D			DA	DA	DA	D		D		DA			D
COMP24011	Introduction to AI	O																																
COMP24112	Machine Learning	O																																
COMP24412	Knowledge Based AI	O	DA				DA													DA						DA				DA				
COMP25212	System Architecture	C			DA						DA	DA	DA								DA													
COMP26020	Programming Languages & Paradigms	C																																
COMP26120	Algorithms and Data Structures	C	DA	DA	DA	DA					DA	DA	DA						DA	DA	DA					DA		DA	DA	DA				
COMP27112	Introduction to Visual Computing	O	DA																										DA					
COMP28112	Distributed Systems	O																																
COMP30040	Third Year Project Laboratory	C									D	D	D			D	D	D						D	D	D	D	D	D				D	
COMP32211	Implementing System-on-Chip Designs	C		DA	DA						DA	DA	DA			DA			D	DA	DA			DA				D	DA					
COMP32412	The Internet of Things: Architectures and Applications	O	D	DA	D		D		D		D		DA		DA	DA								DA										
COMP33511	User Experience	O	DA	D	D		D				DA		D						D											DA				
COMP33712	Agile Software Engineering	O																																
COMP34120	AI and Games	O																																
COMP34212	Cognitive Robotics	O					DA			DA		D					D		D	D						D								
COMP34412	Natural Language Systems	O		DA			DA				DA		DA						DA									DA						
COMP35112	Chip Multiprocessors	C		DA	DA		DA				DA		DA				DA			DA														
COMP36111	Algorithms and Complexity	O		DA							DA	DA	DA							DA										DA				
COMP36212	Mathematical Systems and Computation	O		DA							DA	DA	DA							DA										DA				
COMP36511	Compilers	O																																
COMP37111	Advanced Computer Graphics	O	DA	DA			DA				DA																							
COMP37212	Computer Vision	O	D	D			D				D																							
COMP38211	Documents and Data on the Web	O																																
COMP38411	Cryptography and System Security	O	D		D	D	D				D		D						D															

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 the in the hands of the Director of Teaching Strategy (currently Dr Steve Pettifer) who chairs a School Teaching Strategy Committee.