Programme Specification for

BEng Honours Computer Systems Engineering

Middlesex University London

1. Programme title	BEng Honours Computer Systems Engineering
2. Awarding institution	Middlesex University
3. Teaching institution	Middlesex University
4. Details of accreditation by professional/statutory/regulatory body	
5. Final qualification	BEng (Hons)
6. Year of validation **Year of amendment**	
7. Language of study	English
8. Mode of study	Full Time/ Part Time

9. Criteria for admission to the programme

Students should normally have the equivalent of 240 UCAS entry points to gain entry to level 4. All candidates should possess at least grade C in GCSE maths and English language, or equivalent.

Mature applicants with relevant work experience are also welcome to apply.

For direct entry to levels 5 & 6 the student is required to pass 120 credits at levels 4 & 5, respectively, and demonstrate the programme learning outcomes have been met at these level by, for example, the attainment of industrially based qualifications or experience.

Mature applicants with relevant work experience are also welcome to apply for Direct entry at levels 3, 4 and 5. These applicants are required to submit a portfolio of work experience to show evidence of achieving relevant learning outcomes, and these will vary depending on both the programme and level the student is applying for. Evidence should comprise the applicant's own work and may include documents you have written, procedures you have designed, proposals you have drafted, electronic resources, photographs, video etc or information gathered from others about you such as statements from employers, certificates of in-house courses completed. Further guidance may be obtained from the Programme Leader or Director of Programmes.

International students who have not been taught in the English medium must show evidence of proven ability in English such as TOEFL grade 550 or IELTS grade 6.0. The University provides pre-sessional English language courses throughout the year for candidates who do not meet the English requirements. University policies supporting students with disabilities apply, as described in the University Regulations, 'Information for students with disabilities'.

10. Aims of the programme

The general aim of the BEng Hons to produce fledgling practitioners in computer systems engineering who have been exposed to an engineering ethos and are thus aware of the importance of designing and implementing a system on-time and within-budget. More specifically, the programme aims to explore the concepts, principles and practices underlying the design and implementation of up-to-date real- world computer systems including those operate at Internet scale, and development needed in a variety of problem domains, and provides the opportunity of learning how to develop such systems. In addition, the programme has a focus on real-time systems. For example, collision avoidance systems for vehicle response to events in real time; others such as engine management systems need to respond to the many events monitored ,and to respond appropriately - perhaps by making a small change in one or more conditions being monitored - and on time. Students are introduced to the development of hardware and software facilitating real-time performance.

BEng graduates will possess highly marketable skills, and experience, in design, implementation and testing of systems, permitting entry to specialist areas within the computer systems engineering sector as well as to the network sector as a whole. They will be prepared for careers in the sector and will have an appropriate knowledge and a range of advanced skills in demand by Industry They will appreciate new and emergent trends, the standards required of a professional practitioner and will be capable of designing, implementing and test systems using industry-standard platforms and development tools and have a range of practical skills in demand and highly valued by the computer systems and network sector.

11. Programme outcomes

A. Knowledge and understanding

 On completion of this programme the successful student will have knowledge and understanding of:
1. The laws, principles and concepts of mathematics, including logic, discrete and real-valued mathematics) underpinning the development of computer systems and the analysis and solution of relevant engineering problems;
2. The principal computational concepts, scientific and engineering principles required to analyse and model routine computer systems, products and processes and collect and interpret data needed by the solution of routine design problems and to recognise their limitations

Teaching/learning methods

In general, students will gain knowledge and understanding via teaching and learning strategies based on a wide variety of learning sessions including supervised laboratories and workshops, the setting of practical tasks involving individual problem solving and design, discussion, peer cooperation in problem-solving and practical exercise, encouragement of asking of questions and open-mindedness. Lectures present key concepts which typically are then applied in seminars, case studies/examples coursework and laboratory work. Timely formative feedback is offered prior to formal submission of work that is summatively

3. Criteria of quality and performance relevant to computer systems engineering design, construction or operational contexts;
4. The relevance and ramifications of a *range* of professional, legal, managerial, business, organisational, ethical, social and sustainability considerations relevant to the practice of the computer based systems professional;
5. The significance, role and function of computer systems engineering practitioners within society and the operational, material environment within which they will be expected to practise;
6. The business, organisational and management techniques relevant to those engaging in enterprise and the production of computer systems, products and processes.
7. The core concepts and principles of design methodology specific to particular computer communications products and processes and how to apply these;
8. Use of a systems approach to solving complex computer systems engineering problems and the evaluation of the limitations of such solutions in practice.

assessed.

The curriculum is designed to offer the opportunity of academic progression between levels of study within identifiable **computer systems** and closely related themes supported by the programme.

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At level 4, modules introduce the conceptual, technical, mathematical and engineering underpinnings of the study of computer systems engineering. A1 and A2 are addressed at the outset within the contexts of networking, computer architecture and the STEM modules by means of closely supervised laboratories, lectures, practical sessions and supervised seminars. Students are encouraged to understand the relevance and point of these underpinnings to the development and analysis of computer systems.

Tasks are set expressly to consolidate this knowledge and understanding is designed to engender confidence and proficiency at topic level.

Reference is made to A3 in relevant contexts by way of illustrative case studies. Elements of A4-A6 are introduced where appropriate, to motivate an initial understanding, and to place technical topics into a wider real world context. Key elements of A7 are introduced at this level in focussing on the design of small-scale systems. The concept of a systems approach to problem solution (A8) is introduced implicitly and simply at this level.

Case studies, design issues, problems needing solution and analytical work are

all introduced at topic-level rather than at system level and are designed to provide opportunities of practically applying underpinning theory and principle.

At Level 5, further material addressing A1 and A2 is introduced via lectures, seminars or workshops; the opportunity is offered through contact sessions to apply this content at a relatively greater system- level: illustrative examples and topics introduced in each module involve typically an increasingly systems-level content through which design work, problem solving and analysis tasks are based, as measured by *t*he demands of coursework and seminar or lab based tasks.

Progressively increasing levels of appreciation of and determination of quality performance aspects of computer systems products, processes and medium scale systems is encouraged and expected. A3 is acquired through case studies, deployment of analytical techniques and problem solving Involving issues of quality Students participate in a significant piece of group project work, engaging in a task akin to one that may be found in industry; knowledge and understanding outcomes A3-A6 are addressed. Outcomes A7 and A8 are addressed in modules across Level 5 studies and involve software and hardware design tasks in labs, seminars discussion of taught principles.

At Level 6, Students are expected to consolidate their understanding of new material delivered through lectures, seminar activity, problem solving tasks and independent study and coursework in acquiring A1 and A2 and A3, and are actively encouraged to take greater responsibility for the selection of concepts, principles and operational laws needed to analyse and synthesise particular computer systems products, processes and products relevant to the programmes core focus and content.

Individual project work addresses A5-A6; further knowledge and understanding of A7 and A8 is gained though Level 6 taught modules. Student learning includes the opportunity of appreciating the open-endedness and incompleteness of knowledge in solving practical computer systems contexts at system level and provide scope for the adaptation of systems to meet new needs.

Formative feedback is offered frequently and in a timely fashion in a variety of ways including written feedback on the return of draft coursework, feedback in situ within laboratories, seminars and workshops as appropriate. In general, formative feedback is offered prior to submission of work that will be summatively assessed, again in a variety of formats including written, and oral, individual feedback, generic group or class feedback.

Assessment Methods

Programme outcomes are assessed by means of a wide variety of techniques including coursework assessment, laboratory experimentation, analysis and synthesis tasks, and tests, problem solving exercises, modelling and simulation tasks, seminar work (including presentations, formal reports of work undertaken or work-in-progress, dialogue) all of which are framed at progressively more complex systems-based content.

Typically, *each* module involves a variety of assessment techniques to take into account students' differing learning styles.

Written examinations at Levels 5, and 6 are designed to assess students' knowledge and understanding; outcomes A4-A6 are assessed through

B. Cognitive (thinking) skills	Teaching/learning methods
	individual and group project reports.
On completion of this programme the successful student will be able to:	Skill development within this programme is intended to be progressive across all study levels.
1. Engage effectively in tasks requiring initial problem identification and to effectively apply relevant engineering principles and techniques appropriate to the analysis and solution of a *range* of technical problems arising out of either well-defined or underdetermined scenarios typical in application contexts found in the sector, use of creativity and innovation in practical contexts;	At Levels 4-6, cognitive skill development takes place using lectures, workshops and seminars and laboratories and through design projects, problem solving activities, technical presentations and through report and project writing.
2. Integrate a broad understanding of computer systems engineering, related subjects, mathematics, design and business practice to formulate solutions to unfamiliar computer systems engineering problems; acquire and critically evaluate technical information, concepts arguments and assumptions and evidence derived from a wide variety of sources; to abstract from such information, to correctly apply those concepts and restate arguments and assumptions in a variety of ways appropriate for a given cognitive end or purposes;	B1 is acquired through lab activity, lectures, seminars and workshops; B2 is acquired through workshop activity and presentations; B3 is acquired through project activity at Levels 5, 6 and 7; initially through seminar presentations at Level 4; B4 acquired through seminars/workshops (problem solving tasks) and, project activity; B5 is acquired through, seminars, laboratory activity, through lectures, analysis tasks undertaken in seminars/workshops and through coursework assignments; B6 is acquired through project seminar activities and supervision.
3. *Critically* evaluate information, concepts, arguments and assumptions and evidence derived from a wide variety of sources; to abstract from such information, to correctly apply those concepts and restate arguments and assumptions in a variety of ways appropriate for a given cognitive end or purpose;	Formative feedback is given prior to submission of work for summative assessment. In group or project work; formative feedback is offered prior to assessment of deliverables. Students are encouraged to study independently outside contact sessions
4. Solve technical problems creatively in problem-solving and design contexts drawing on techniques or concepts some of which are at the forefront of computer systems development or research and to deal with issues creatively in the presence of incomplete data;	**Assessment methods**
*A*nalyse computer communication systems, devices and components; relate such analysis to the design of new	Student's cognitive skills are typically summatively assessed by combinations of practical assignments, group and individual presentations, laboratory exercises, production of design documentation and specific demonstration

systems and processes and to modify an existing system, component or process, evaluate the performance of existing systems and components through analytical methods and modelling technique

Adopt an integrative systems approach to design activity and problem solving which defers to economical, ethical, social, and human-computer interaction principle; design a new computer system or adapt a system to provide for a new or changed operational need.

of work and in part, unseen written examinations, multiple choice questions, dialogue in workshops and presentations and vivas.

Formative feedback / assessment (both individual and generic) is given prior to submission of work submitted for summative assessment. Summative feedback is issued generally with returned assessed coursework, or by email, or online. Verbal feedback is given by tutors for presentations; generic feedback on examination performance is given in the form of a module report.

C. Practical skills

On completion of the programme the successful student will be able to:

C. Use specialist digital, wireless and network laboratory equipment safely and effectively in all phases of computer systems development

D. Conduct experiments, simulations and modelling tasks with *minimal* guidance, and report effectively on findings;

E. Use technical literature effectively and conduct a *specialist* literature search effectively; plan and conduct a technical investigation using a wide range of technical literature

F. Co-design moderately complex systems using a range of high-level software, and hardware description and languages; design and implement a range of programs written in a range of industry- standard programming languages, as appropriate, to initialise, control and configure hardware and network applications; analyse and develop a range of

Teaching/learning methods

In general, students develop practical skills through design projects, specific skills inputs and set exercises.

Practical skills development is supported by a variety of high-end digital, wireless, network, computer and software laboratories. These provide teaching environments and tools for system design, simulation, and test are used to foster the development of cognitive skills specified by C1-C6 through a range of laboratory and/or seminar-based tasks typically relying on learning-in-action Opportunities for developing subject-specific practical skills are aligned with many different activities including supervised laboratory tasks at Levels 4-6, in which a range of tasks are set, ranging from the use of packet analysers and network modelling tools to industry-standard hardware prototyping and development systems, in which students gain experience in all stages of both hardware and software development life cycles

Students acquire and develop practical skills in a variety of ways including supervised laboratories, workshops and

high-performance Internet-based communication platforms and applications 5. Document design and analytical work appropriately; commission, research, and sustain individual project activity and to report on findings in a defensible fashion relying on minimal supervision; 6. Develop and evaluate range of computer-based systems or processes typically involving the substantive integration of hardware and software components and fulfilling a given set of requirements; document design and analytical work appropriately.	*seminars involving* *appropriate tasks designed to develop the range of skills.* *Laboratory and workshop activity typically relay on learning-in-action; supportive, supervised laboratories foster the development of skills C1, C2, C4, and C6 and 1-1 tutor feedback is given in situ. A variety of digital, wireless, software, networking laboratories provide complete learning environments including hardware and development tools for system design, programming, simulation to foster the development of practical skills.* *Skills C3 and C5 are acquired through individual and group project wok* ## *Assessment Method* *Assessment of such skills take place via laboratory activities and via coursework based on the production of a computer-based system, software development and a variety of design and analysis of hardware subsystems.* *Prior to assessment of subject-specific skills, students will have received formative feedback.* *Typically laboratory based work require written formal reports in which documentation of steps taken, results and an evaluation form an integral part of assessment.* *Outcomes C1-C6 are summatively assessed via a range of instruments including laboratory tasks, coursework assignments and group and*
D. Graduate skills On completion of this programme the successful student will be able to: 1. Work effectively both autonomously in independent project-oriented activity and co-operatively as a	**Teaching/learning methods** Students acquire Graduate skills D1-D5 through participating in many different activities, seminar and laboratory work, presentations, lab- based tasks, written assignments. In particular D3 is first

member of a group or project-team, and manage time and other resources;
2. Apply mathematical skills and understanding to tasks requiring modelling, system analysis and problem-solving;
3. Learn effectively for life-long personal and career development and to reflect on progress of learning;
4. Communicate effectively and explain technical information, concepts, arguments, design information effectively, using a variety of media, and range of methods appropriate to a given type of audience or communication objective;
5. Conduct research effectively, drawing on a wide variety of sources (including libraries, the Internet and electronic catalogues) under minimal direction, and be proficient in the use of referencing sources of information.
6. Deploy the *general* design, implementation and test principles or techniques appropriate for the development of particular computer system product or process and apply a scientific approach to problem solving.

addressed at L4; and D1 is conspicuously developed within the Level 5 project development module, and Level 6 are developed in the project/project activity modules

Assessment method

Students' graduate skills are assessed by a variety of assessment types are typically used for each of the intended graduate skills outcomes. These include seminar-based assessment, multiple-choice questions, laboratory tasks taking place in learning environments including specialist development tools or equipment, as appropriate, group and individual projects, a*nd* mini projects.

Reports reflecting research undertaken at all levels of study are assessed and formative feedback provided. Individual and group project research presentations are assessed.

Skills outcomes D1-D6 are designed to reflect the University's Graduate Skills requirements. These skills are addre ment through small-group activities providing the student with the opportunity of contributing to their Personal Development Portfolios (PDPs)

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12. Programme structure (levels, modules, credits and progression requirements)

12. 1 Overall structure of the programme

The BEng programme can be taken in three modes (a) full-time, (b) part-time and (c) thick-sandwich mode. In full-time mode, the programme will take three years to complete; in part-time mode the
BEng programme will take a minimum of six years to complete and (c) will take a minimum of four years to complete. The programme is
structured into three academic levels.

Each module is worth 30 credit points and so you need gain 120 credit points to progress to the next level. In part-time mode, you will take a maximum of 60 credit points in any academic year (which is defined to be the period from September to the following September). In thick sandwich mode you will spend a year on a placement module after having completed the first two academic levels, and then resume your studies by taking the specified level 3 modules. Even though the placement module is credit-rated (worth 120 credit points) it does not affect to the number of credits needed to gain your honours degree award, however it leads to a certificate of industrial achievement in its own right indicating the credits points gained.

In this BEng programme all modules are compulsory and you need 360 credit points to graduate with honours. S tudents may be eligible for pre-accreditation of some modules, especially at Level 4 if you have already passed industrially recognised courses relevant to these and be at the same academic level or if you have significant and appropriate employment experience prior to starting the programme.

If, on completion of your studies you fail to obtain the 360 credit points required by the BEng programme, you may be eligible for graduating with non-honours, i.e. an ordinary, degree, if you have obtained 300 credit points, at least of which 60 credit points are at Level 5 and at least of which 60 credit points are at Level 6.

12.2 Levels and modules		
Level 4 (1)		
COMPULSORY	OPTIONAL	PROGRESSION REQUIREMENTS

Students must take all of the following: **CCE1000** Computer Systems Architecture and Operating Systems **CCE1010** Programming for Data Communications and Problem Solving **CCE1020** Fundamentals of Science, Technology, Engineering and Mathematics **CCE1030** Computer Networks		Students must pass 120 credit points to progress to level five full-time study or level five part-time study
Level 5 (2)		
COMPULSORY	OPTIONAL	PROGRESSION REQUIREMENTS

COMPULSORY	OPTIONAL	PROGRESSION REQUIREMENTS
Students must take all of the following: **CCE2050** Engineering Software Development **CCE2040** Digital System Design **CCE2060** Research Methodology and Professional Project Management **CCE2020** Protocols and Network Performance Modelling		. Students must pass at least 180 credit points (including 60 at level 5) in order to be eligible to enrol on modules at level 6, and at least 210 credits (including 90 at level 5) in order to be eligible to enrol on the level 6 individual project module.
Level 6 (3)		
COMPULSORY	OPTIONAL	PROGRESSION REQUIREMENTS
Students must take all of the following: **CCE3050** Individual Project **CCE3000** Real-time Systems **CCE3110** Internet Scale Applications and Development **CCE3010** Embedded Linux Systems and Application Development		In order to graduate with an honours degree i.e. with a BEng Hons Computer Systems Engineering award, students must have achieved 360 credit points, or to graduate with an ordinary degree, 300 credit points with a minimum of 60 credit points at Level 6

12.3 Non-compensatable modules (note statement in 12.2 regarding FHEQ levels)

Module level	Module code
Level 5	**CCE 2060** *Research Methodology* and Professional Project Development
Level 6	***CCE3050** Individual Project*

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13. Curriculum map

See attached.

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14. Information about assessment regulations

- Information on how the University formal assessment regulations work, including details of how award classifications are determined, can be found in the University Regulations at www.mdx.ac.uk/regulations/.
- Practical aspects of the programme are often assessed via coursework that may be carried out using specialist software and may include lab tests.
- Theoretical material is assessed by coursework and examinations.
- Grades are awarded on the standard University scale of 1–20, with Grade 1 being the highest. To pass a module all components, both coursework and examination, must be passed individually with a minimum grade of 16. Failure in one of the components will result in the failure of the module.

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15. Placement opportunities, requirements and support (if applicable)

All Undergraduate students have the opportunity to go on Industrial Placement. Industrial Placements are encouraged as this valuable experience enhances a student's future career prospects. Additionally students normally achieve better results in their final year. In brief:

- The placement provides a years experience as an appropriately paid graduate trainee.
- Industrial placement is conditional on the successful completion of all modules at Level 4 and Level 5; therefore students need 240 credits before they are able to embark on an industrial placement.
- Obtaining a placement is co-ordinated through the Campus Placement Office.
- For Undergraduate programmes, students wishing to undertake a placement position must register for CCE3200.
- Each placement will be assigned to an industrial tutor who will visit the student on placement.

On graduation the degree will be qualified with the term "…with approved industrial experience"

16. Future careers (if applicable)

All programmes in the School of Science and Technology – their curricula and learning outcomes – have been designed with an emphasis on currency and the relevance to future employment.

- The majority of graduates are employed in IT posts relevant to the subject.
- Over 20% of students pursue further postgraduate study or research.

The employer links with the School are encouraged in a number of ways e.g. by inviting practitioners from industry as guest speakers in lectures; through links with companies where students are employed as part of their Industrial placement and through alumni both in the UK and overseas

Campus Careers Offices can be found on each campus for advice, support and guidance – or go to www.intra.mdx.ac.uk/annex/careers/coreered.htm

Career-wise, the broad coverage of computer engineering components keep a wide range of options open, whilst exposure to system development allows entry and progression to top flight jobs in the computer systems engineering sector. Middlesex's reputation of providing competent Computer and Communication engineering practitioners and its reputation in digital and networking, wireless and mobile computing provision will ensure ensures that graduates are highly regarded by employers.

Computer systems applications developer
Network IP-telephony developer
Network applications developer
Protocol development
Network server/client developer
Network hardware and software developer/consultant
Cloud system operative / system management
 Network Security
Scalable computer systems: application, design and management
Cloud computing systems , content distribution management;
Internet system development – network and specialist software
Server farm development and management
Computer systems designer/engineer
Real web computing developer

17. Particular support for learning (if applicable)

The School's Teaching and Learning Strategy is compliant with those of the

University, in seeking to develop learner autonomy and resource-based learning.

In support of the students learning experience: The School's Teaching and Learning Strategy is compliant with those of the University, in seeking to develop learner autonomy and resource-based learning In support of the students learning experience:

- All new students go through an induction programme and some have early diagnostic numeric and literacy testing before starting their programme. Learning Resources (LR) provide workshops for those students needing additional support in these areas.

- Students are allocated a personal email account, secure networked computer storage and dial-up facilities.

- New and existing students are given module handbooks for each module they study. Copies of all module handbooks can be found on Unihub, Web-based learning materials are provided to further support learning

- Extensive library facilities are available on all campuses.

  MyUniHub pages are available as learning resources through UniHub

- Students can access advice and support on a wide range of issues from the UniHelp Student Information Desk.

- Placements are supported by Placement Offices and School academics; please refer to section 15 of this programme specification

High-quality specialist network, software, digital and wireless laboratories equipped with industry standard software, hardware and tools as appropriate, for formal teaching as well as self-study

Middlesex University is a Cisco Local Academy and Arm, Opnet and Xilinx University partners

- Teaching staff are available for each subject offering personal academic advice and help if needed. Staff availability for this purpose is posted outside staff office doors.

- Formative feedback is given on completion of student coursework

- Past exam papers with solutions and marking schemes for all modules are available for students in module handbooks and from http://www.UniHub.mdx.ac.uk/

- Research activities of academic staff feed into the teaching programme, which can provide individual students with ad-hoc opportunities to work with academics on some aspect of research

Middlesex University encourages and supports students with disabilities. Some practical aspects of Science and Technology programmes may present challenges to students with particular disabilities. Students are encouraged to visit our campuses at any time to evaluate facilities and talk in confidence about their needs. If we know students' individual needs we'll be able to provide for them more easily. For further information contact the Disability Support Service (email: disability@mdx.ac.uk).

18. JACS code (or other relevant coding system)	
19. Relevant QAA subject benchmark group(s)	Computing/ Engineering

20. Reference points

The following reference points were used in designing the programme:

- QAA Computing subject benchmark statements, Computing (2007) and Engineering (2010)
- QAA Framework for Higher Education Qualifications in England, Wales and Northern Ireland
- UK Standard for Professional Engineering Competence; Chartered Engineer and Incorporated Engineer Standard, Engineering Council UK, 2010.
- QAA guidelines for programme specifications
- QAA Code of Practice for the assurance of academic quality and standards in HE
- IET Handbook for Learning Outcomes Handbook Incorporating UK-SPEC for Bachelors and MEng Degree Programmes (2008)
- British Computer Society (BCS) Guidelines for Exemption and Accreditation
- CBI - Future Fit: Preparing graduates for the world of work, 2009.
Available at: http://www.cbi.org.uk/media-centre/news-articles/2009/03/future-fit/
- University Regulations
- Module Narratives
- Middlesex University and School of Engineering and Information Sciences Teaching Learning and Assessment policies and strategies
- University policy on equal opportunities.

21. Other information

Middlesex University has formal links with 250 institutions world-wide, including student exchange agreements with more than 100 institutions. Currently a number of students both from the UK/EU and overseas take part in such exchanges. For further details please visit http://www.europe.mdx.ac.uk/.

Curriculum map for BEng Honours Computer Systems Engineering

This section shows the highest level at which programme outcomes are to be achieved by all graduates, and maps programme learning outcomes against the modules in which they are assessed.

Programme learning outcomes

Knowledge and understanding		Practical skills	
A1	The laws, principles and concepts of mathematics, including logic, discrete and real-valued mathematics) underpinning the development of computer systems and the analysis and solution of relevant engineering problems.	C1	Use specialist digital, wireless and network laboratory equipment safely and effectively in all phases of computer systems development.
A2	The principal computational concepts, scientific and engineering principles required to analyse and model routine computer systems, products and processes and collect and interpret data needed by the solution of routine design problems and to recognise their limitations.	C2	Conduct experiments, simulations and modelling tasks with *minimal* guidance, and report effectively on findings.
A3	Criteria of quality and performance relevant to computer systems engineering design, construction or operational contexts;	C3	Use technical literature effectively and conduct a *specialist* literature search effectively; plan and conduct a technical investigation using a wide range of technical literature;

| A4 | The relevance and ramifications of a *range* of professional, legal, managerial, business, organisational, ethical, social and sustainability considerations relevant to the practice of the computer based systems professional. | C4 | Design or Co-design moderately complex systems using a range of high-level software, and hardware description and languages; design and implement a range of programs written in a range of industry-standard programming languages, as appropriate, to initialise, control and configure hardware and network applications; analyse and develop a range of high-performance Internet-based communication |

			platforms and applications.
A5	The significance, role and function of computer systems engineering practitioners within society and the operational, material environment within which they will be expected to practise.	C5	Document design and analytical work appropriately; commission, research, manage and sustain individual project activity and to report on findings in a defensible fashion relying on minimal supervision.
A6	The business, organisational and management techniques relevant to those engaging in enterprise and the production of computer systems, products and processes.	C6	Develop and evaluate a range of computer-based systems or processes typically involving the substantive integration of hardware and software components and fulfilling a given set of requirements; test design ideas in a practical environment and analyse and evaluate these.
A7	The core concepts and principles of design methodology specific to particular computer communications products and processes and how to apply these;		
A8	Use of a systems approach to solving complex computer systems engineering problems and the evaluation of the limitations of such solutions in practice.		
Cognitive skills		**Graduate Skills**	
B1	Engage effectively in tasks requiring initial problem identification and to effectively apply relevant engineering principles and techniques appropriate to the analysis and solution of a *range* of technical problems arising out of either well-defined or underdetermined scenarios typical in application contexts found in the sector, use of creativity and innovation in practical context.	D1	Work effectively both autonomously in independent project-oriented activity, and co-operatively as a member of a group or project-team and manage time and other resources.
B2	Integrate a broad understanding of computer systems engineering, related subjects, mathematics, design and business practice to formulate solutions to unfamiliar	D2	Apply mathematical skills and understanding to tasks requiring modelling, system analysis and problem-solving.

	computer systems engineering problems; acquire and critically evaluate technical information, concepts arguments and assumptions and evidence derived from a wide variety of sources; to abstract from such information, to correctly apply those concepts and restate arguments and assumptions in a variety of ways appropriate for a given cognitive end or purposes		
B3	*Critically* evaluate technical information, concepts, arguments and assumptions and evidence derived from a wide variety of sources; to abstract from such information, to correctly apply those concepts and restate arguments and assumptions in a variety of ways appropriate for a given cognitive end or purpose.	D3	Learn effectively for life-long personal and career development and to reflect on progress of learning.
B4	Solve technical problems creatively in problem-solving and design contexts drawing on techniques or concepts some of which are at the forefront of computer systems development or research and to deal with issues creatively in the presence of incomplete data.	D4	Communicate effectively and explain technical information, concepts, arguments, design information effectively, using a variety of media, and range of methods appropriate to a given type of audience or communication objective.
B5	Analyse computer communication systems, devices and components; relate such analysis to the design of new systems and processes and to modify an existing system, component or process, evaluate the performance of existing systems and components through analytical methods and modelling techniques.	D5	Conduct research effectively, drawing on a wide variety of sources (including libraries, the Internet and electronic catalogues) under minimal direction, and be proficient in the use of referencing sources of information.
B6	Adopt an integrative systems approach to design activity and problem solving which defers to economical, ethical, social, and human-computer interaction principle; design a new computer system or adapt a system to provide for a new or changed operational need.	D6	Deploy the *general* design, implementation and test principles or techniques appropriate for the development of particular computer system product or process and apply a scientific approach to problem solving.

BEng Hons Programme outcomes																									
A1	A2	A3	A4	A5	A6	A7	A8	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	C5	C6	D1	D2	D3	D4	D5	D6
Highest level achieved by all graduates																									
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6

Module Title	Module Code by Level	Programme Outcomes																											
		A1	A2	A3	A4	A5	A6	A7	A8	B1	B2	B3	B4	B5	B6	B7	B8	C1	C2	C3	C4	C5	C6	C7	D1	D2	D3	D4	D5	D6
Computer Systems Architecture and Operating Systems	CCE1000		√	√				√		√		√		√				√				√	√	√	√				√	
Programming for Data Communication and Problem Solving	CCE1010		√	√				√		√		√	√	√		√			√			√		√	√	√	√	√		√
Fundamentals of Science, Technology, Engineering and Mathematics	CCE1020	√	√	√				√	√	√		√	√		√	√		√			√	√		√		√			√	√
Computer Networks	CCE1030	√		√				√	√	√	√		√		√	√		√	√			√			√				

Course	Code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Protocols and Network Performance Modelling	CCE2020	√	√	√			√	√	√				√	√			√	√	√		√		√	√		√
Engineering Software Development	CCE2050		√	√			√	√	√		√		√	√	√		√	√	√		√		√	√		√
Research Methodology and Professional Project Development	CCE2060			√	√	√	√		√		√	√	√	√		√		√	√	√	√		√	√		√
Supervised Placement Module	CCE3200				√	√	√		√		√	√				√	√	√		√	√		√			
Digital System Design	CCE2040	√	√	√			√	√	√		√		√	√		√		√	√		√	√		√		√
Real-time Systems	CCE3000		√	√			√	√	√		√	√	√	√		√		√	√		√		√	√		√
Individual Computer Communications Project	CCE3050			√	√	√	√		√	√	√	√	√	√		√	√		√	√	√	√	√	√	√	√
Internet Scale Applications and Development	CCE3110	√	√	√			√	√	√		√	√	√	√		√	√		√	√	√	√	√	√		√