Programme Specification

MEng Computer Engineering

1. Programme title	MEng Computer Engineering
2. Awarding institution	Middlesex University
3. Teaching institution	Middlesex University
4. Details of accreditation by professional/statutory/regulatory body	
5. Final qualification	MEng
6. Year of validation **Year of amendment**	
7. Language of study	English
8. Mode of study	FT/PT

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.

1. Mature applicants with relevant work experience are also welcome to apply.
2. 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.

10. Aims of the programme

The general aim of the MEng 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.

MEng 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	Teaching/learning methods
On completion of this programme the successful student will have knowledge and understanding of: 1. A Comprehensive selection of the laws, principles and concepts of mathematics (including logic, discrete and real-valued mathematics) underpinning the development of computer- and scalable network-based systems needed within the computer systems engineering discipline; 2. A comprehensive range of computational, engineering and scientific principles needed to analyse, model, simulate and implement computer	. 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,

systems, products and processes and to draw conclusions from the result of collecting data required to solve unfamiliar, innovative or novel design problems using emergent or new technologies; 3. Criteria of quality and performance relevant to contexts involving complex computer systems engineering design, construction or operation; the proposal or development, and application, of such criteria; 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. An extensive range of business, organisational and management techniques relevant to those engaging in enterprise and the production of computer systems, products and processes; 7. A comprehensive range of the principles, processes and methods of *design* and how to apply these in the design of novel systems and processes and in unfamiliar scenarios; 8. Use of a *systems* approach to solving complex computer systems engineering problems and techniques to evaluate the limitations of such solutions in practice;	case studies/examples coursework and laboratory work. Timely formative feedback is offered prior to formal submission of work that is *summatively* 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.* **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 i 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 the demands of coursework and seminar or lab based tasks. Progressively increasingly 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. **At Level 7,** The emphasis is on deepening, extending and consolidating knowledge and understanding of gained in Level 6 studies (A1-A3, A7 and A8);ntroduced implicitly and simply at this level. project work involves incorporation of significant industrial input addresses outcomes A4, A5 and A6 and provide the opportunity of demonstrating innovation in design and implementation taking into account contemporary developments in technology. 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 individual and group project reports.
B. Cognitive (thinking) skills On completion of this programme the successful student will be able to: 1. Use a systems approach to define and investigate computer systems problems; apply relevant scientific and engineering principles appropriate for the analysis and solution of a wide range of *design* and technical problems arising out of both well-defined and underdetermined scenarios and through critical thinking investigate new and emerging technology; 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 arising; *Acquire and critically evaluate technical information, concepts, arguments, assumptions, and evidence derived from a wide range of sources* including research, current and emergent developments *in computer systems engineering; abstract from such information, correctly apply those concepts and restate arguments and evidence in a variety of ways appropriate for given design or analytical ends or purposes;* 4. Identify and solve a wide range of technical problems creatively in problem-solving or design contexts which are at the forefront of computer systems development; deal with and problems arising creatively in the face of incomplete information; 5. Analyse computer systems, devices and components and relate such analysis to the design of new systems and processes and to modify an existing system, component or process; evaluate	**Teaching/learning methods** Skill development within this programme is intended to be progressive across all study levels. 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. 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. 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

the performance of existing systems and components through empirical and analytical methods and modelling techniques, and to investigate new and emerging technologies. 6. Adopt an integrative systems approach to design 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;	outside contact sessions. **Assessment methods** 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 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: 1. Use specialist digital, wireless, network equipment safely and effectively and a range of specialist software and hardware development environments effectively in the analysis, design, test and implementation of digital, mobile and wireless systems and processes; 2. Conduct experiments, simulation and modelling tasks with *minimal* guidance, and report effectively on findings; 3. Use technical literature effectively and conduct a *specialist* literature review**;** plan and conduct a technical investigation using a wide range of technical literature; Co-design and develop complex systems using a range of high-level software, hardware description languages; design and implement a range of algorithms in a range of appropriate industry-standard programming languages,	**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

to initialise, control and configure hardware and to implement network communication applications; analyse and develop a range of high-performance Internet-based communication platforms and applications; 5. Plan, commission, research, manage and sustain individual and team project activity and report on findings and results in a defensible fashion relying on minimal supervision: establish end-user or system needs; production of design detail, construction of product or process and their evaluation, verification; production of a critical design and implementation review; defer to a *wide range* of commercial or industrial constraints in such work and in the evaluation of technical work show appreciation of the *limitations* of proposed solutions; 6. Create and critically evaluate a range of complex computer-based systems, applications or processes typically involving the substantive integration of hardware and software elements and fulfilling a given set of requirements akin to those found in industry; document design and analytical work effectively and appropriately; test design ideas in a practical environment and analyse and evaluate these; adapt and generate an innovative design for computer systems, products and components in order to fulfil new needs. .	laboratories, workshops and 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 work At Level 7, the acquisition and development of C4 and C6 involves increased complexity of co-design, analysis and hardware design tasks and a critical appreciation of the limitations of proposed project solution and typically involve the opportunity of receiving, reflecting and responding to industrial input. ***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 individual project activities and workshop and seminar activities and tests. Formative feedback is given prior to submission of work for summative assessment

D. Graduate skills	Teaching/learning methods
On completion of this programme the successful student will be able to: 1. Work effectively both autonomously in individual activity, and co- operatively as a member of a group or project-team and manage time and other resources; practise decision making in complex and unpredictable design and problem-solving contexts; 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; demonstrate leadership skills and initiative; 4. Communicate effectively and explain complex technical information, concepts, arguments, design information effectively, using a variety of media, and wide 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 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	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 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 methods** 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 and coursework, laboratory tasks taking place in learning environments including specialist development tools or equipment, as appropriate, group and individual projects, and 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 addressed initially at Level 4, many opportunities are provided for their development through small-group activities providing the student with the opportunity of contributing to their Personal Development Portfolios (PDPs) .

12. Programme structure (levels, modules, credits and progression requirements)
12. 1 Overall structure of the programme

The BEng part of the 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.

The MEng year can be taken in (a) full-time mode, and (b) part-time mode. In full-time mode, Level 7 studies will take one year; (b) will take a minimum of two years to complete.

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.

Students may be eligible for pre-accreditation of some modules, especially at Level 5 if you have already passed courses relevant to those modules and at the same academic level or if you have significant and appropriate employment experience prior to starting the programme. In the MEng programme, the modules are all compulsory, and you will need 480 credits to graduate with an MEng award.

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.

If you gain less that the requisite credit points achieved by the end of your MEng studies, you may be eligible for a PG Cert or PG Diploma.

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

Students must take all of the following: **CCE2050** Engineering Software Developmen t **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: 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. To progress to Level 7 studies, students must have achieved 360 credit points.

Level 7 (MEng)		
COMPULSORY	OPTIONAL	PROGRESSION REQUIREMENTS
Students must take all of the following:		In order to graduate with an MEng in Computer Systems Engineering,

CCE4999 MEng Project Activity **CCE4020** Topics in Computer Systems Engineering **CCE4310** Network Design and Performance Evaluation		students must have passed 360 credit points at Level 6 and 120 Credits points at Level 7

12.3 Non-compensatable modules (note statement in 12.2 regarding FHEQ levels)	
Module level	**Module code**
5	**CCE 2060** *Research Methodology and* Professional Project Development
6	***CCE3050*** *Individual Project*
7	**CCE4999** MEng Project Activity

13. Curriculum map

See attached.

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.

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".

The placement option is not available to direct-entry students in their final year.

16. Future careers (if applicable)

- 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.

1. Computer systems applications developer
2. Network IP-telephony developer
3. Network applications developer
4. Protocol development
5. Network server/client developer
6. Network hardware and software developer/consultant
7. Cloud system operative / system management
8. Network Security
9. Scalable computer systems: application, design and management
10. Cloud computing systems , content distribution management;
11. Internet system development – network and specialist software
12. Server farm development and management
13. Computer systems designer/engineer

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)	*I100/H100 – 40% / 60% split*
19. Relevant QAA subject benchmark group(s)	Computing/ Engineering

20. Reference points

- 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.
- UK Standard for Professional Engineering Competence; the Accreditation of Higher Education Programmes, Engineering Council UK, 2008.
- 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/.

Appendix 2: Curriculum Map

Curriculum map for *MEng (Hons) 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	A comprehensive selection of the laws, principles and concepts of mathematics, (including logic, discrete and real-valued mathematics) underpinning the development of computer-and scalable network-based systems needed within the computer systems engineering discipline.	C1	Use specialist digital, wireless, network equipment safely and effectively; and a range of specialist software and hardware development environments effectively in the analysis, design, test and implementation of digital, mobile and wireless systems and processes.
A2	A comprehensive range of computational and scientific principles needed to analyse, model, simulate and implement computer systems, products and processes and to draw conclusions from the result of collecting data needed for the solution of unfamiliar problems or of	C2	Conduct experiments, simulation and modelling tasks with minimal guidance, and report effectively on findings.

	innovative or novel design problems using emergent or new technologies.		
A3	Criteria of quality and performance relevant to contexts involving complex computer systems engineering design, construction or operation; the proposal or development, and application, of such criteria.	C3	Use technical literature effectively and conduct a *specialist* literature review; 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	Co-design and develop complex systems using a range of high-level software, hardware description languages; design and implement a range of algorithms in a range of appropriate industry-standard programming languages, to initialise, control and configure hardware and to implement network communication 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	Plan, commission, research, manage and sustain individual and team project activity and report on findings and results in a defensible fashion relying on minimal supervision: to establish end-user or system needs; production of design detail, construction of

			product or process and their evaluation, verification; production of a critical design and implementation review; defer to a *wide range* of commercial or industrial constraints in such work and in the evaluation of technical work show appreciation of the *limitations* of proposed solutions.
A6	An extensive range of business, organisational and management techniques relevant to those engaging in enterprise and the production of computer systems, products and processes.	C6	Create and critically evaluate a range of complex computer-based systems, applications or processes typically involving the substantive integration of hardware and software elements and fulfilling a given set of requirements akin to those found in industry; document design and analytical work effectively and appropriately; test design ideas in a practical environment and analyse and evaluate these; adapt and generate an innovative design for computer systems, products and components in order to fulfil new needs.
A7	Comprehensive range of the principles, processes and methods of design and how to apply these in the design of novel systems and processes and in unfamiliar scenarios.	C7	
A8	Use of a systems approach to solving complex computer systems engineering problems and to evaluate the		

	limitations of such solutions in practice.		
Cognitive skills		**Graduate Skills**	
B1	Use a systems approach to define and investigate computer systems problems; apply relevant scientific and engineering principles appropriate for the analysis and solution of a wide range of design and technical problems arising out of both well-defined and underdetermined scenarios and through critical thinking investigate new and emerging technology	D1	Work effectively both autonomously in individual activity, and co-operatively as a member of a group or project-team and manage time and other resources; practise decision making in complex and unpredictable design and problem-solving contexts;
B2	Integrate a broad understanding of computer systems engineering, related subjects, mathematics, design and business practice to formulate solutions to unfamiliar computer systems engineering problems arising;	D2	Apply mathematical skills and understanding to tasks requiring modelling, system analysis and problem-solving;
B3	Acquire and critically evaluate technical information, concepts, arguments, assumptions, and evidence derived from a wide range of sources *including research, current and emergent developments in computer systems engineering*; abstract from such information, correctly apply those concepts and restate arguments and evidence	D3	Learn effectively for life-long personal and career development and to reflect on progress of learning; demonstrate leadership skills and initiative

	in a variety of ways appropriate for given design or analytical ends or purposes;		
B4	Identify and solve a wide range of technical problems creatively in problem-solving or design contexts which are at the forefront of computer systems development; deal with issues and problems arising creatively in the face of incomplete information	D4	Communicate effectively and explain complex technical information, concepts, arguments, design information effectively, using a variety of media, and wide range of methods appropriate to a given type of audience or communication objective;
B5	Analyse computer systems, devices and components and 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 empirical and analytical methods and modelling techniques, and to investigate new and emerging technologies.	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 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 *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

MEng Computer Systems Engineering Programme outcomes																									
A 1	A 2	A 3	A 4	A 5	A 6	A 7	A 8	B 1	B 2	B 3	B 4	B 5	B 6	C 1	C 2	C 3	C 4	C 5	C 6	D 1	D 2	D 3	D 4	D 5	D 6
Highest level achieved by all graduates																									
7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7

Module Title	Module Code by Level	Programme Outcomes																												
		A 1	A 2	A 3	A 4	A 5	A 6	A 7	A 8	B 1	B 2	B 3	B 4	B 5	B 6	B 7	B 8	C 1	C 2	C 3	C 4	C 5	C 6	C 7	D 1	D 2	D 3	D 4	D 5	D 6
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	✓		✓				✓	✓	✓	✓			✓		✓	✓					✓	✓		✓		✓			
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	✓	✓	✓				✓	✓	✓		✓	✓	✓		✓	✓		✓	✓		✓	✓		✓	✓	✓	✓		✓
MEng Project Activity	CCE4999			✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓		✓	✓	✓	✓			✓

Network Design and Performance Evaluation	CCE4310		✓	✓				✓		✓		✓		✓		✓	✓		✓		✓	✓	✓		✓	✓	✓		✓	✓
Topics in Computer Systems Engineering	CCE4020	✓	✓	✓				✓	✓	✓		✓	✓	✓		✓			✓		✓	✓	✓		✓	✓	✓	✓	✓	✓