Programme Specification and Curriculum Map for BEng Honours Computer Communication and Networks

1. Programme title	BEng (Hons) Computer Communication and Networks
2. Awarding institution	Middlesex University
3. Teaching institution	Middlesex University
4. Programme accredited by	N/A
5. Final qualification	BEng (Hons)
6. Academic year	2014/2015
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'.
For further information, visit the learning resources web site at:
http://www.lr.mdx.ac.uk/lang/index.htm.

10. Aims of the programme

The scope for developing useful computer communication systems demanding high performance appears virtually unlimited. The focus of this programme is on digital systems as providing the critical core of many systems in widespread use, ranging from routers to the processing cores of mobile devices. Collision avoidance systems need to respond to events in the environment in near real time; others such as engine management systems need to respond to the many events monitored and to respond appropriately and on time, perhaps by making a small change in one or more conditions being monitored. Particular areas of interest to this programme are the development of digitally –based systems that facilitate high performance applications, and the prototyping of high-performance systems using contemporary programmable logic.

This programme explores a broad range of technologies and science underlying computer-based communication systems, processing, wireless LANs, mobile computing, computer systems, and digital communications.

The main aim of this BEng Hons programme is to produce fledgling practitioners in the area who have been exposed to an engineering ethos and are thus aware of the importance of designing and implementing systems fit for purpose, on-time and within-budget. In particular, graduates will possess a range of highly marketable skills and experience in the design and implementation process, akin to those found in the industry, sectors including the computer communication and the networking sectors.

11. Programme outcomes
A. Knowledge and understanding

On completion of this programme the successful student will have knowledge and understanding of:

1. The mathematics communication and engineering principles relevant to the analysis and solution of a range of high performance digital and computer communication, wireless networking and telecommunication security problems and issues, and in the test of systems designed;
2. The principal concepts, operational laws, scientific , software and computer engineering principles underlying the development of computer, wireless and digital systems;
3. Criteria of quality and performance relevant to computer communication and network systems 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 communication engineers and practitioners within society and the operational, material environment within which they will be expected to practise;
6. A range of professional, legal, managerial, business, organisational, ethical, social and sustainability considerations of relevance to professional practice; appreciate the significance, role and function of computer practitioners within society and the material environment within which products and processes are developed; judgment appropriate for successful project development within the constraints of professional practice;
7. The core principles, processes and methods of design and how to apply these in the design of specific computer communication and network systems and processes; use of appropriate modelling techniques, semi-formal and formal notations as appropriate to clarify, evaluate, document and to communicate design concepts;
8. Use of a systems approach to solving complex computer communication problems and to evaluate the limitations of such solutions in practice;

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 including individual problem solving and design, discussion, peer co-operation in problem-solving and practical exercise, encouragement of asking of questions and open-mindedness, lectures to present key concepts which are then typically applied in seminars case studies/examples and laboratory work, timely summative and formative feedback, coursework and laboratory work. In general, formative feedback is provided prior to the submission of coursework assignments and laboratory work as appropriate.

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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* 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 are 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 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.

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. 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;
2. Integrate a broad understanding of computer communications and networks and 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

3. 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

4. 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;

5. Analyse computer communication and network 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;

6. 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.

Teaching/learning methods

Skill development within this programme is intended to be progressive across all study levels.

A variety of digital, wireless, network, computer and software laboratories provide environments and tools for system design, simulation, and test are used to foster the development of practical skills specified by B1-B5 through a range of laboratory and/or seminar-based tasks typically relying on learning-in-action. Supportive environments allow the development of B1-B5; formative feedback on performance of B1-B5 development is offered by tutors within laboratories and seminars prior to assessment, and then more formal feedback is offered.

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 and project activity;
B5 is acquired through, seminars and laboratory activity and through lectures;
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 outside contact sessions.

Assessment Method

Student's cognitive skills are typically summatively assessed by combinations of practical assignments, contribution as members of a group task, and individual presentations, laboratory exercises, production of design documentation and specific demonstration of work and on occasion: 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

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 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 search effectively; plan and conduct a technical investigation using a wide range of technical literature;
4. Model hardware systems and component functionality, and prototype a range of digitally-based computer communication systems or processes; implement a range of algorithms in hardware using VHDL or Verilog, Matlab, and computer software, for a selection of computer communication and networking purposes; and evaluate a range of applications;
5. Plan, commission, research and sustain computer communication and networking 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; apply principles and techniques that defer to a wide range of commercial or industrial constraints in such work and in the evaluation of technical work showing appreciation of the limitations of proposed solutions.
6. Develop and evaluate range of digitally based, digital communication and mobile systems or processes typically involving the substantive integration components and fulfilling a given set of requirements; document design and analytical work appropriately;

Teaching/learning methods
Opportunities for developing subject-specific skills are aligned with supervised laboratory tasks 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 experience both hardware and software development life cycles

At level 4 students will exercise subject level skills in undertaking small scale simulation, implementation and design tasks.

At Level 5 students will apply existing skills and develop further skills in using development and test environments, together with gaining further experience in the prototyping and modelling of systems, and in debugging relatively complex systems consisting of both hardware and software subsystems. C4 and C6 are assessed in the group project module.

At Level 6 practical skillsC1,C2 and C5 will be developed across the three of the four modules taken at this level.

Assessment Method
Assessment of such skills will take place via laboratory sessions and via coursework tasks based on the production or analysis of a digital or computer-based system, software and hardware subsystems. Prior to assessment of subject-specific skills, students will receive formative feedback. Typically laboratory based work will result in a formal report in which documentation of steps taken, results and an evaluation form part of assessment; At level 7, outcome 7 is supported by more complex projects tasks in which for example the realisation of a complete prototype meeting a significant set of requirements .

D. Graduate Skills

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

1. Work effectively both autonomously in individual tasks and project-oriented activity, and co-operatively as a member of a group or project-team and manage time and other resources; exercise independent decision making in unfamiliar and non-routine 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
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 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.

Teaching/learning methods

Students acquire graduate skills through presentations, lab-based tasks including independent and group project work

Assessment method

Students' graduate skills are assessed by a variety of assessment types are tare typically used for each of the intended 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 taught, and assessed at Level 4, and skills development allows students the opportunity of contributing to their Personal Development Portfolios (PDPs)
D6 is assessed in contexts where a range of design principles are used in developing a variety of software and hardware artefacts - ranging from rapidly prototyped hardware sub-systems to exacting interfacing requirements.

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 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 contribute to the number of credits you need to gain your honours degree award, but leads to a certificate of industrial achievement in its own right.

In this programme all modules are compulsory and you need 360 credit points to graduate with honours. The modules at Level one of this programme are common to four other programmes and it is possible that you could transfer your studies to one of these in order to take a range of computer communication modules that are not featured in this programme.

Students may be eligible for pre-accreditation of some modules, especially at Level 1 if you have already passed courses relevant to those modules and at the same academic level or if you have significant employment experience prior to starting the programme.

If, on completion of your studies you fail to obtain the 360 credit points required by this 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.

On successful completion of the BEng programme, you may progress to the final year of the MEng programme, in either full time or part-time mode

In full-time mode, the programme will take one year to complete; in part-time mode the programme will take a minimum of two years to complete.

12.2 Levels and modules		
Level 4		
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		
COMPULSORY	**OPTIONAL**	**PROGRESSION REQUIREMENTS**
Students must take all of the following:		Students must pass at least 180 credit points

COMPULSORY	OPTIONAL	PROGRESSION REQUIREMENTS
CCE2060 Research Methodology and Professional Project Management **CCE2020** Protocols and Network Performance Modelling **CCE 2000** Data Communications **CCE2030** Digital Systems Engineering		(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

COMPULSORY	OPTIONAL	PROGRESSION REQUIREMENTS
Students must take all of the following: **CCE3050** Individual Project **CCE3140** Digital Communications **CCE3120** Digital Systems: Applications **CCE3840** Wireless LANs and Mobile Computing		In order to graduate with an honours degree i.e. with a BEng (Hons) Computer Communication and Networks 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	CCE 3050 Individual project

13. Curriculum map for BEng Honours Computer Communication and Networks

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 mathematics communication and engineering principles relevant to the analysis and solution of a range of high performance digital and computer communication, wireless networking and telecommunication security problems and issues, and in the test of systems designed;	C1	Use specialist digital, wireless, network equipment safely and effectively; and a range of specialist development environments effectively in the analysis, design, test and implementation of digital, mobile and wireless systems and processes;
A2	The principal concepts, operational laws, scientific , software and computer engineering principles underlying the development of computer, wireless and digital systems and appreciate relevant criteria of quality;	C2	Conduct experiments, simulation and modelling tasks with *minimal* guidance, and report effectively on findings;
A3	Criteria of quality and performance relevant to computer communication and network systems 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	Model hardware systems and component functionality, and prototype a range of digitally-based computer communication systems or processes; implement a range of algorithms in hardware using VHDL or Verilog, Matlab, and computer software, for a selection of computer communication and networking purposes; and evaluate a range of applications;
A5	The significance, role and function of computer communication engineers and practitioners within society	C5	Plan, commission, research and sustain computer communication and networking individual and team

	and the operational, material environment within which they will be expected to practise;		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; apply principles and techniques that defer to a wide range of commercial or industrial constraints in such work and in the evaluation of technical work showing appreciation of the limitations of proposed solutions;
A6	A *range* of professional, legal, managerial, business, organisational, ethical, social and sustainability considerations of relevance to professional practice; appreciate the significance, role and function of computer practitioners within society and the material environment within which products and processes are developed; judgment appropriate for successful project development within the constraints of professional practice.	C6	Develop and evaluate range of digitally based, digital communication and mobile systems or processes typically involving the integration of components and fulfilling a given set of requirements; document design and analytical work appropriately;
A7	The core principles, processes and methods of design and how to apply these in the design of specific computer communication and network systems and processes; use of appropriate modelling techniques, semi-formal and formal notations as appropriate to clarify, evaluate, document and to communicate design concepts	C7	
A8	Use of a systems approach to solving complex computer communication problems and to evaluate the limitations of such solutions in practice;		

Cognitive skills		Graduate Skills	
B1	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;	D1	Work effectively both autonomously in individual tasks and project-oriented activity, and co-operatively as a member of a group or project-team and manage time and other resources; exercise independent decision making in unfamiliar and non-routine 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; 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 design or analysis task or other cognitive end or purpose;	D2	Apply mathematical skills and understanding to tasks requiring modelling, system analysis and problem-solving;
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	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	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;

	and innovation in practical contexts;		
B5	Analyse computer communication and network 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

Programme outcomes for BEng Hons Computer Communication and Networks

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

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
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	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
Computer Systems Architecture and Operating Systems	CCE1000		√	√				√		√		√		√				√				√	√	√	√	√	
Programming for Data Communication and Problem Solving	CCM1010		√	√				√		√		√	√	√		√							√		√	√	√
Fundamentals of Science, Technology, Engineering and Mathematics	CCE1020	√	√	√				√	√	√			√	√		√	√		√			√	√		√		√
Computer Networks	CCM1030	√		√				√	√	√			√			√	√					√	√		√		√
Data Communications	CCM2000	√	√	√				√	√					√								√	√		√	√	
Protocols and Network Performance Modelling	CCE2020	√	√	√				√	√	√						√	√			√		√	√		√		√
Digital Systems Engineering	CCE2030	√	√	√	√		√	√		√			√		√	√			√	√	√	√	√	√		√		
Research Methodology and Professional Project Development	CCE2060			√	√	√	√			√		√	√	√	√			√		√		√	√		√	√	√
Optional: Industrial Placement	CCE3200				√	√	√			√	√		√	√				√		√		√		√	√	√	
Digital Systems: Applications	CCE3120		√	√				√	√	√		√	√	√		√	√		√		√	√	√		√		
Digital Communications	CCE3140	√	√	√	√			√					√			√	√	√		√	√	√	√		√		
Individual Computer Communications Project	CCE3050			√	√	√	√	√	√	√	√	√	√	√				√		√	√	√		√	√	√	√
Wireless LANs and Mobile Computing	CCE3080		√	√		√		√	√	√	√		√	√	√	√	√		√		√	√	√		√	√	√

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. Normally, to pass a module all principal assessable components, such as coursework and unseen written 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.   For additional information on assessment and how learning outcomes are assessed please refer to the individual module narratives for this programme.

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 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 the Industrial placement module 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 of the BEng programmes.

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.

Careers or progression opportunities available for BEng students

- Engineering: design, implementation and test of digital hardware
- Wireless network designer/analyst
- Network system administrator
- Network device developer
- High-performance digital systems designer or engineer
- Network modeller and designer
- System prototyping
- Digital Communications,
- Wireless network management
- Hardware programmer
- Network application programmer

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

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.

- 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 students are provided with School's Programme Handbooks at enrolment (electronic copies for all students can also be found at http://www.mdx.ac.uk/24-7/cs/#subjecthandbook)

- New and existing students are given module handbooks for each module they study. Soft 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. WebCT pages are available as learning resources through the UniHub

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

- Placements are supported by Campus 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 Xilinx and

ARM University partners; It enjoys a strong link with National Instruments (NI).

- 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 at 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

18. JACS code (or other relevant coding system)
I100/H100 (50%/50%)

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
- 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/
- Middlesex University Learning Teaching and Assessment Strategy (2012 – 2014)
- 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/.

Please note programme specifications provide a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve if s/he takes full advantage of the learning opportunities that are provided. More detailed information about the programme can be found in the Module Narratives