

# Programme Specification and Curriculum Map for MEng Communication and Networks



<b>1. Programme title</b>	MEng Computer Communication and Networks
<b>2. Awarding institution</b>	Middlesex University
<b>3. Teaching institution</b>	Middlesex University
<b>4. Programme accredited by</b>	N/A
<b>5. Final qualification</b>	MEng
<b>6. Academic year</b>	2015/2016
<b>7. Language of study</b>	English
<b>8. Mode of study</b>	Full Time/ Part Time

## 9. Criteria for admission to the programme

- Student 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 levels by, for example, the attainment of appropriate 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 MEng 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.

MEng graduates will possess an *extensive set* 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. A comprehensive selection of mathematics, communication and engineering concepts and principles relevant to the analysis and solution of a range of high-performance digital and computer communication wireless networking and telecommunication problems and security issues, and in the test of systems designed;
2. A comprehensive range of operational laws, scientific , software and computer engineering principles underlying the development of computer communication, wireless and digital systems and appreciate relevant criteria of quality; draw conclusions from the result of systematically collecting data need for the solution of unfamiliar problems arising in innovative or novel design contexts using emergent or current technologies;
3. Criteria of quality and performance relevant to contexts involving complex communication and network system design, construction or operation; the proposal or development, and the formulation and application of such criteria as appropriate;
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 managerial, operational, material environment within which they will be expected to practise;
6. An extensive range of professional, legal, managerial, business,

### ***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* assessed.

The curriculum is designed to offer the opportunity of academic progression between levels of study within identifiable computer communication and network themes 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 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.

**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); 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, 6 and 7 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. 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;
2. Integrate a broad understanding of computer systems engineering, related subjects, mathematics, design and business practice to formulate solutions to unfamiliar computer communication and network problems arising;
3. Acquire and critically evaluate technical information, concepts, arguments and assumptions and evidence derived from a wide variety of sources including research, current and emergent computer communication and network technologies; abstract from such information, correctly apply those concepts and restate arguments and assumptions in a variety of ways appropriate for given design, analytical and other cognitive ends or purposes;
4. Use of a systems approach to define, investigate and solve computer communication problems; apply relevant scientific and engineering principles appropriate to the analysis and solution of a wide range of design and technical problems arising out of either well-defined or underdetermined scenarios using appropriate techniques and through critical thinking; investigate new and emerging technology;
5. Analyse complex computer communication and network system, 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 and to investigate relevant 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 communication system, product or process or adapt a system to provide for a new or changed operational need in the light of current and emergent technology.

### ***Teaching/learning methods***

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-B6; formative feedback on performance of B1-B6 development is offered by tutors within laboratories and seminars prior to assessment, and then *more formal* feedback are offered. Skill development within this programme is intended to be continuous 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 and project activity;  
B5 is acquired through, seminars, 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.

At level 7, acquisition of skill B3 involves students undertaking a critical review of a wide range of research in computer systems engineering and this is supported by appropriate presentations in workshops or seminars and project work.

B4 is acquired through complex problem-solving tasks in workshops, seminars and coursework in each taught module.

Acquisition of B5 is addressed through lectures (as appropriate), analysis tasks undertaken in seminars/workshops and laboratories and through coursework assignments.

### **Assessment Method**

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 prior 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 development environments effectively in the analysis, design, test and implementation of digital, mobile and wireless systems and processes;
2. Formulate and conduct experiments 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

4. Model an extensive range of hardware and component functionality; and to prototype complex, high-performance hardware-based systems within a digital or computer communications context;
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 digital and communication systems, applications or processes typically involving the complex integration of custom and proprietary hardware, and software elements as appropriate, and fulfilling a given set of requirements akin to those found in industry; document design and analytical work effectively and 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 developing and modelling of high-speed digital and digital communication systems, and in debugging relatively complex systems consisting of both hardware and software subsystems.

**At Level 6** practical skills will be further developed across the four modules taken involving the development of digital communication and wireless products and processes.

**At Level 7** specialist practical skills are developed further according to those relevant to taught content.

### ***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 A6 is supported by more complex project work and tasks in which for example a complete system prototype meeting a significant set of requirements is created.

### **D. Graduate Skills**

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

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1. 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; 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 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.

### ***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 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 instead to a certificate of industrial achievement in its own right. If you gain 360 credit points at the end of Level 6 studies you are eligible for the BEng Hons Computer Communication and Networks award.

In this MEng programme all modules are compulsory and you need 480 credit points to graduate. 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 480 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 (Levels 4-6), you may study on 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.

<b>12.2 Levels and modules</b>		
<b>Level 4</b>		
<b>COMPULSORY</b>	<b>OPTIONAL</b>	<b>PROGRESSION REQUIREMENTS</b>
<p>Students must take all of the following:</p> <p><b>CCE1000</b> Computer Systems Architecture and Operating Systems</p> <p><b>CCE1010</b> Programming for Data Communications and Problem Solving</p> <p><b>CCE1020</b> Fundamentals of Science, Technology, Engineering and Mathematics</p> <p><b>CCE1030</b> Computer Networks</p>		<p>Students must pass 120 credit points to progress to level five full-time study or level five part-time study</p>
<b>Level 5</b>		
<b>COMPULSORY</b>	<b>OPTIONAL</b>	<b>PROGRESSION REQUIREMENTS</b>

Students must take all of the following:

**CCE2060**

Research Methodology and Professional Project Management

**CCE2020**

Protocols and Network Performance Modelling

**CCE 2000**

Data Communications

**CCE2040**

Digital System Design

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**

**COMPULSORY**

**OPTIONAL**

**PROGRESSION  
REQUIREMENTS**

<p>Students must take all of the following:</p> <p><b>CCE3050</b> Individual Project</p> <p><b>CCE3140</b> Digital Communications</p> <p><b>CCE3040</b> Advanced Networking and Security</p> <p><b>CCE3080</b> Wireless LANs and Mobile Computing</p>		<p>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</p> <p>In order to progress to Level 7 of this MEng programme, students must have achieved 360 credit points at Level 6.</p>
Level 7 (MEng)		
COMPULSORY	OPTIONAL	PROGRESSION REQUIREMENTS

<p>Students must take all of the following:</p> <p><b>CCE4999</b> MEng Project Activity</p> <p><b>CCE4830</b> Mobile Communications</p> <p><b>CCM4850</b> Telecommunication Security</p> <p><b>CCE4840</b> Broadband Technologies and Fibre Optics</p>	<p>In order to graduate with an MEng in Computer Communication and Networks, students must have passed 360 credit points on the BEng Computer Communication and Network programme and 120 Credits points at Level 7</p>
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<b>12.3 Non-compensatable modules (note statement in 12.2 regarding FHEQ levels)</b>	
Module level	Module code
Level 5	CCE 2060 Research Methodology and Professional Project Development
Level 6	CCE 3050 Individual project
Level 7	CCE 4999 MEng Project Activity

<b>13. Curriculum map</b>
See Curriculum Map attached

<b>14. Information about assessment regulations</b>
<ul style="list-style-type: none"> <li>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 <a href="http://www.mdx.ac.uk/regulations/">www.mdx.ac.uk/regulations/</a>.</li> <li>Practical aspects of the programme are often assessed via coursework that may be carried out using specialist software and may include lab tests.</li> </ul>

- 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 5 and Level 6 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 MEng 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 MEng students

- Engineering: implementation 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 consultancy
- Digital Communications,
- Wireless network management
- Hardware 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](http://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 the Programme Handbook at enrolment (electronic copies for all students can also be found on <http://www.unihub.mdx.ac.uk>).
- 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. UniHub pages are available as learning resources through the UniHubsystem
- 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.mdx.ac.uk/24-7/cs/index.htm>

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)**

## 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 programme handbook and the University Regulations.

# Curriculum map for MEng 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	A comprehensive selection of 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 problems and security 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; practise decision making in complex and unpredictable design and problem-solving contexts
A2	A comprehensive range of operational laws, scientific, software and computer engineering principles underlying the development of computer communication, wireless and digital systems and appreciate relevant criteria of quality; draw conclusions from the result of systematically collecting data need for the solution of unfamiliar problems arising in innovative or novel design contexts using emergent or current technologies;	C2	Formulate and conduct experiments and modelling tasks with minimal guidance and report effectively on findings;
A3	Criteria of quality and performance relevant to	C3	Use technical literature effectively and

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	contexts involving complex communication and network system design, construction or operation; the proposal or development, and the formulation and application of such criteria as appropriate;		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	Model an extensive range of hardware and component functionality; and to prototype complex, high-performance hardware-based systems within a digital or computer communications context;
A5	The significance, role and function of computer communication engineers and practitioners within society and the managerial, operational, material environment within which they will be expected to practise;	C5	Plan, commission, research, manage 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: 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 professional, legal, managerial, business, organisational, ethical, social and sustainability considerations relevant to professional practice;	C6	Create and critically evaluate a range of complex digital and communication systems, applications or processes typically involving the complex integration of custom and proprietary hardware, and software elements as

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			appropriate, and fulfilling a given set of requirements akin to those found in industry;
A7	An extensive range of principles, processes and methods of design and how to apply these in the design of novel systems and processes, and in unfamiliar scenarios; a variety of modelling techniques, semi-formal and formal notations as appropriate to clarify, evaluate, document and communication design concepts;	C7	
A8	Use of a systems approach to solving complex computer communication and network problems and to critically evaluate the limitations of such solutions in practice;		
<b>Cognitive skills</b>		<b>Graduate Skills</b>	
B1	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;	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; exercise 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; acquire and critically evaluate technical information and current research results, concepts, arguments,	D2	Apply mathematical skills and understanding to tasks requiring modelling, system analysis and problem-solving;

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	assumptions, and evidence derived from a wide range of sources including research and current 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 a range of given cognitive ends or purposes;		
B3	Acquire and critically evaluate technical information, concepts, arguments and assumptions and evidence derived from a wide variety of sources including research, current and emergent computer communication and network technologies; abstract from such information, correctly apply those concepts and restate arguments and assumptions in a variety of ways appropriate for given design, analytical and other cognitive ends or purposes;	D3	Learn effectively for life-long personal and career development and to reflect on progress of learning; demonstrate leadership skills and initiative;
B4	Use of a systems approach to define, investigate and solve computer communication problems; apply relevant scientific and engineering principles appropriate to the analysis and solution of a wide range of design and technical problems arising out of either well-defined or underdetermined scenarios using appropriate techniques and through critical thinking; investigate new and emerging technology;	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 complex computer communication and network system, devices and components, relate such analysis to the design of new systems and	D5	Conduct research effectively, drawing on a wide variety of sources (including libraries, the Internet and electronic

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	processes and to modify an existing system component or process, evaluate the performance of existing systems and components through analytical methods and modelling techniques and to investigate relevant new and emerging technologies;		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 communication system, product or process or adapt a system to provide for a new or changed operational need in the light of current and emergent technology.	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**

A	A	A	A	A	A	A	A	B	B	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D	D
1	2	3	4	5	6	7	8	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
<b>Highest level achieved by all graduates</b>																									
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

**Programme outcomes for MEng Computer Communication and Networks**

A	A	A	A	A	A	A	A	B	B	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D	D
1	2	3	4	5	6	7	8	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
<b>Highest level achieved by all graduates</b>																									



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Optional: Industrial Placement	CCE3200				√	√	√			√	√		√	√			√		√		√	√	√					
Advanced Networking and Security	CCE3040		√	√				√	√	√		√	√	√		√	√		√		√	√	√		√			
Digital Communications	CCE3140	√	√	√	√			√					√		√	√	√		√	√		√	√		√			
Individual Computer Communications Project	CCE3050			√	√	√	√		√	√	√	√	√	√	√		√		√		√	√	√		√	√	√	√
Wireless LANs and Mobile Computing	CCE3080		√	√		√		√	√	√	√		√	√	√	√	√		√		√	√	√		√	√	√	√
MEng Project Activity	CCE4999			√	√	√	√		√	√	√	√	√	√	√		√	√		√	√	√		√	√	√	√	√
Telecommunication Security	CCE4850	√		√		√			√	√			√	√					√	√			√	√		√	√	√
System Prototyping	CCE4010	√	√	√				√	√	√	√	√	√	√		√	√		√		√	√	√		√	√	√	√

