

technology innovation centre

Postgraduate Programme

Programme Specification including Student Guide and Employer Guide

MSc Data Networks & Security Research

Date of Course Approval/Review	Current Version Number	Version Date
19 May 2006	1.02	19 May 2006



Definitive Documents and Version Control

This document has a version number and reference date in the footer. The process leading to introduction of new courses, and major changes to courses follows **tic** procedure QA 1 and culminates in approval by the University's Senate.

The process leading to introduction of minor changes to modules and courses follows **tic** procedure QA 5 and culminates in approval by the Dean.

The reference date will be that of the approval event, minor changes board, or other meeting at which formal consideration was given.

Further details about the course and document development may be obtained from minutes of the approval meeting, or minor changes board. A history of the document is summarised in the table below and further information relating to past versions can be obtained from the **tic** Registry.

MSc Data Networks and Security Research Programme Specification, Student and Employer Guides			
Version	Event	Date of event	Authorised by
1.01	Approval	19 May 2006	Dean of Faculty
1.02	Approval (conditions)	19 May 2006	Panel Chair

PROGRAMME SPECIFICATION

MSc Data Networks & Security Research

NOTE: This specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if s/he takes advantage of the learning opportunities that are provided. More detail on the specific learning outcomes, indicative content and the teaching, learning and assessment methods of each module can be found (1) at <http://web.tic.ac.uk>, (2) in the Theme Book, and (3) in the Student Handbook. The accuracy of the information contained in this document is reviewed by the University and may be checked within independent review processes undertaken by the Quality Assurance Agency.

The information from this specification may be selectively extracted and included in documents that are more appropriate for students, intending students and employers.

1	Awarding Institution / Body:	UCE Birmingham
2	Teaching Institution:	Technology Innovation Centre, UCE Birmingham
3	Programme accredited by:	N/A
4	Final Award:	MSc
5	Programme Title:	Data Networks & Security Research
6	UCAS Code:	N/A
7	QAA Benchmarking Group:	N/A

- 8 Aims of the programme**
The programme aims to provide learners with:
- research skills and an opportunity to demonstrate these skills through the execution of a research based master's project.
 - an opportunity to develop skills in securing research funding through the production of research proposals based on sound technical and economic rationale.
 - a course which will develop skills of analysis, synthesis, decision making and the ability to cope with unfamiliar problems through effective research methods.
 - a curriculum providing essential knowledge and understanding of generic networking principles.
 - the skills to develop multidisciplinary approaches to the development of secure data networking systems.
 - an opportunity to investigate how computer based data network systems are designed, developed and enhanced in order to provide competitive advantage and gain market share.
 - a wide range of transferable and marketable skills and knowledge leading to employment opportunities in a variety of roles within a wide range of industries.
 - a teaching and learning environment which emphasises active and participative education;
 - an opportunity to acquire skills necessary for lifelong learning;

9 Intended learning outcomes and the means by which they are achieved and demonstrated: the programme provides learners with opportunities to develop and demonstrate knowledge and understanding, skills and other attributes as follows:

Knowledge and understanding

Knowledge and understanding of:	Teaching, learning and assessment methods used:
<p>Why the development of sound research methods are essential in order to plan and execute research projects at Master's level and beyond.</p> <p>The skills necessary to develop a sound research proposal based on a good technological and economic basis.</p> <p>The application of appropriate research methodologies to a range of topics.</p> <p>The requirements of various funding bodies with respect to the development of a full research proposal in either academia or for commercial R&D.</p> <p>The approvals process for the acceptance of research proposals.</p> <p>A defined body of knowledge, skills and understanding and analyse its relationships with conceptual frameworks and where appropriate, professional practice in industry and commerce.</p> <p>The essential skills of analysis, synthesis, decision-making and the ability to apply such to resolve project challenges and unfamiliar problems.</p>	<p>Knowledge and understanding are acquired through rich media web based curricula and computer simulations.</p> <p>Face-to-face traditional lecture, seminar, tutorial and self study.</p> <p>Directed independent learning activities are encouraged at all stages of the course.</p> <p>There is a major emphasis on hands-on and practical learning to re-enforce and theory material, both supervised and unsupervised.</p> <p>Tutors and peers perform knowledge and competence assessment, this is both formative and summative. These include seminars, viva-voce, coursework, practical case studies, theory projects, written/online examinations, and practical assessments.</p>

Skills and other attributes

<p>Intellectual / cognitive skills: Argue rationally and draw independent conclusions based on a rigorous, analytical and critical approach to demonstration and argument.</p> <p>Synthesise theory and practice to design/implement a range of solutions.</p> <p>Assess and resolve issues relating to competing demands on resources.</p> <p>Write fully researched and referenced reports, which evaluate both technical and management issues. This will involve the use of a variety of IT tools.</p> <p>Demonstrate, in an analysis of a specified problem, a high level of competence and understanding of the data manipulation, information presentation and delivery.</p> <p>Apply new technologies and techniques to solve present and future industrial and commercial problems nationally and internationally.</p> <p>Use relevant analytical and modelling techniques to plan and complete a project.</p>	<p>Teaching, learning and assessment methods used: Intellectual skills are developed through teaching and learning programme previously outlined.</p> <p>Analytical and problem solving skills are further developed using a range of appropriate 'real' and 'theoretical' case-studies and problem based learning scenarios.</p> <p>Each Theme attracts 27 credits with a notional 270 hours. The theme will normally have up to 3 elements of assessment.</p> <p>The course comprises 4 themes, 2 core to the domain and 2 research orientated. All themes require an element of written work, which will demonstrate the students' ability to apply the knowledge gained to a specific problem.</p> <p>The themes related to the host course require a major project report to be produced which demonstrates the students' ability to apply the knowledge gained to the solution of a practical problem.</p> <p>The research themes require the student to develop a research proposal with an analysis of funding opportunities. The Research Methods theme requires the student to carry out an analysis of experimental data. The themes will require the student to produce a technical paper and associated presentation.</p>
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<p>Practical, research and independent learning skills: Access information from the internet, journals, books, research papers and appraise its suitability for master's level research.</p> <p>Demonstrate the ability to work autonomously or in a group and accept responsibility for the action taken.</p> <p>Reflect on personal practice, attributes, both theory and practice and modify approach to maximise learning opportunities as required.</p> <p>Interpret and critically evaluate knowledge, concepts and ideas and/or forms of creative expression, to deliver a quality product or service.</p> <p>Comprehend and solve mathematical or analytical problems at a level required by the chosen course of study.</p> <p>Demonstrate the knowledge and skills outlined within the PSDU and PPDU Learning Outcomes.</p> <p>Apply the knowledge, skills and methodologies of project management to the analysis and solution of complex problems.</p> <p>Possess a defined body of knowledge, skills and understanding and analyse its relationships with conceptual frameworks and, where appropriate, professional practice.</p> <p>Draw independent conclusions based on analysis of argument, opinion and data.</p>	<p>Teaching, learning and assessment methods used: The acquisition of appropriate and transferable practical skills is central to the learning strategy of the programmes</p> <p>Initiative and independence are fostered throughout, and develop incrementally as the course progresses.</p> <p>Emphasis is place on guided, self-directed and student-centred learning, with increasing independence of approach, thought and process. This independent learning includes a process of peer review in order to evaluate the effectiveness of the learning.</p> <p>Learners are encouraged to plan their own work schedules and are required to meet strict deadlines.</p> <p>Learners are required to plan and execute a related dissertation.</p> <p>The Postgraduate Study Development Unit provides the vehicle for the development learning skill developments. The PSDU, which is of 60-hours duration comprises:</p> <p>Learning Review- The Postgraduate Learning Review will be started during the Postgraduate Study Development Unit and completed to Stage 1. Assessment of Stage 1 will take place at the end of the PSDU.</p> <p>Learning, Research and ICT skills development- Report writing skills, Information skills, IT skills, Basic mathematical / statistical skills, Oral presentation, Time management, CV preparation.</p> <p>PSDU Assessment includes a variety of competence based formative and summative assessment including interview, preparation of a formal written report, an oral presentation, group activity and the production of an electronic presentation.</p>
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	<p>The Postgraduate Project Development Unit focuses on the identification of a potential Master's project. The PPDU , which is of 60-hours duration comprises:</p> <p>Learning Review- The Postgraduate Learning Review will be completed up to stage 2 and reviewed as part of the assessment of the PPDU.</p> <p>Research and Report writing skills: Types and structure of reports (essays/technical reports/conference papers/executive summaries). Stages of report generation. Reference lists and Bibliographies.</p> <p>Primary and Secondary Research Methodologies.</p> <p>Time management: Analysing weekly schedule. Planning activities. Background/easy/difficult tasks, prioritising.</p>
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Transferable / key skills:	Teaching, learning and assessment methods used:
<p>Elicit the co-operation of others and contribute to team goals</p> <p>Manage time and prioritise workloads</p> <p>Make effective oral and written presentations which are coherent and comprehensible to others</p> <p>Access and make appropriate use of relevant mathematical, statistical and theoretical information.</p> <p>Use various forms of communication and expression, then to employ them selectively, appropriately and effectively according to the requirements of the solution.</p> <p>Plan and deliver an oral presentation, including viva-voce, lead discussion and facilitate arguments, in an eloquent and professional manner, making use of a computer-based presentation aids, where necessary.</p> <p>Identify career opportunities and begin to build a recruitment strategy, including placement opportunities.</p> <p>Show confidence and self-awareness, reflect on own learning, and be self-reliant and constructively self-critical.</p>	<p>Transferable/key skills are core to the learning strategy of the programme. They are pervasive, and are incorporated into themes and assessments as appropriate, for example; team-working skills are fostered through the use of group, task-based practical projects.</p> <p>Keeping logbooks and submitting self-assessment documentation in support of personal performance fosters self management and personal development.</p> <p>The use of information technology plays an integral role throughout the course. The support materials are available through the URLs provided on the theme guides.</p> <p>A full range of resources are identified including books, journals as well as locally created material.</p> <p>Assessment methods include seminars, viva-voce, coursework, practical projects, theory projects, timed examinations and practical assessments</p>

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Programme structure and requirements, levels, modules, credits and awards

The MSc programme is normally studied over one year full-time or two years part-time, and students may if they wish move between full- and part-time modes of attendance. The academic year is divided into semesters of approximately 14 weeks each, which run from September to January and January to June. The course is divided into 7 distinct study units, a Postgraduate Study Development Unit (6 Credits at level 7), a Postgraduate Project Development Unit (6 Credits), four themes, (27 credits) and a Master's project (60 credits). Students complete 120 credits at the Postgraduate Diploma stage and 180 credits at the MSc stage. Each credit represents 10 hours of student learning and assessment.

The structure of the course, the theme, levels and credit ratings and the awards that can be gained are shown below. Personal Development Planning is an integral part of the learning process of each element of the course.

Stage 1	
Theme Name	Credit
Postgraduate Study Development Unit (PSDU)	6
<p>Learning Review- The Postgraduate Learning Review will be started during the Postgraduate Study Development Unit and completed to Stage 1. Assessment of Stage 1 will take place at the end of the PSDU.</p> <p>Learning, Research and ICT skills development- Report writing skills, Information skills, IT skills, Basic mathematical / statistical skills, Oral presentation, Time management, CV preparation.</p>	
DESIGN OF COMMUNICATION SYSTEM I	27
<p>Network Design Concepts, Advanced Routing Protocols, WAN Technologies</p>	
Research Methods	27
<p>This Research Methods theme aims to provide the learning support necessary to acquire these generic and transferable skills, either as preparation for the Master's project and subsequent research programmes or for application in employment following completion of the MSc programme. The theme covers three main areas:</p> <p>Planning and Managing Research Projects</p> <ul style="list-style-type: none"> ▪ Literature searches and Information gathering skills ▪ Ethical considerations; the UCE Research Ethics Framework; ▪ Research questions: Hypothesis formulation; hypothesis testing; model building; model validation ▪ Intellectual Property: identification; ownership and protection of IP. Patents, copyright; design registration; ▪ Time management skills, project planning using MS Project, ▪ Information Management: references; experimental data; the Data 	

Protection Act; design and use of databases for data handling

Experimental Design and Data Analysis

- Experimental Design: design of experiments; analysis and selection of variables, choice of experimental design
- Statistical Techniques: Probability Distributions; Multivariate Distributions; Estimation; Hypothesis testing; ANOVA, Linear regression; Cluster Analysis
- Statistical Software: Minitab, SPSS, Matlab Statistics Toolbox
- Other Analysis Techniques: Frequency Domain; Time-Series; Wavelets

Technical Writing and Presentation Skills

- Introduction to technical writing
- Writing a research degree project proposal
- Writing a conference paper
- Oral presentation skills
- Developing effective presentations using Microsoft PowerPoint
- Writing a thesis

Stage 2	
Theme Name	Credit
<p>Postgraduate Project Development Unit (PPDU)</p> <p>Learning Review- The Postgraduate Learning Review will be completed up to stage 2 and reviewed as part of the assessment of the PPDU.</p> <p>Research and Report writing skills: Types and structure of reports (essays/technical reports/conference papers/executive summaries). Stages of report generation. Reference lists and Bibliographies.</p> <p>Primary and Secondary Research Methodologies.</p> <p>Time management: Analysing weekly schedule. Planning activities. Background/easy/difficult tasks, prioritising.</p>	6
<p>RESEARCH PROPOSAL DEVELOPMENT</p> <p>The theme aims to develop the necessary knowledge through the development of a research funding application, appropriate for submission to a UK Research Council or other OST funding source, for example the DTI. Students will be required to develop both the technical and supporting economic case for undertaking the research, including a well defined project plan and a project budget based on the Full Economic Cost (FeC) model. The theme covers two main areas:</p> <p><u>Developing a Research Proposal</u></p> <p>Structuring a Research Funding application Building the technical case for research Building the economic case for support Partners and collaborators</p>	27

<p>IP protection and exploitation plans Internal and External approval processes <u>Sources of Research Funding</u> Research Council funding including Faraday Centres DTI Funding Sources – Technology and Innovation KTP Programme funding EU FP7 Programme funding Innovation funding sources The FeC model for Research Funding Partial- funding models for collaborative programmes</p> <p>NETWORK SECURITY SYSTEMS</p> <p>Basic security techniques Encryption techniques (DES, RSA, hashing algorithms, etc.) Key exchange mechanisms Design and Implementation of VPN systems</p>	<p>27</p>
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Award: Postgraduate Diploma (120 credits)

<p>Stage 3 Master's Project</p> <p style="text-align: center;">Theme name</p> <p>The project is the ultimate test of the student's ability to integrate and synthesise what has been learnt on the course. It provides an opportunity to apply knowledge gained to a substantial research topic.</p>	<p>Credit 60</p>
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Award: MSc (180 credits)

MSc Data Networks and Security Research

MSc 180 Credits

Master's Project
including Project Proposal and Research Plan and the write-up
600 hours at Level 7 (30 weeks)

PgD 120 Credits

Network Security
27 Credits 270 Hours

Research Proposal Development
27 Credits 270 Hours

PPDU (2 weeks) Preparation for the project – Deliverable 2000 report outlining the proposed area of research for the Master's Project the student would wish to undertake plus the Learning Review to stage 2 - 6 Credits 60 Hours

Design of Communications Systems I
27 Credits 270 Hours

Research Methods
27 Credits 270 Hours

PSDU (2 weeks) Learning Skills Development – Deliverable 2000 word report and presentation related to the specific course being undertaken along with a Learning Review to stage 1 - 6 Credits 60 Hours

11 Support for Learning

Students are encouraged to identify and, with guidance, to reflect on their own learning needs and are offered the following support as appropriate to those needs:

A 60 hour PSDU that includes a review and assessment of the fundamental requirements of the study.

A 60 hour PPDU that focuses on the requirements for the Master's project.

A fully resourced Learning Centre.

A student handbook containing information relating to the University, **tic** and the themes of study.

A virtual learning environment to support students remotely via collaborative tools and technologies, the **tic** intranet, Mytic, and the MSc Support Site.

Access to teaching, support and management staff.

Access to **tic** and UCE resources seven days per week e.g. Library, eLearning materials – outside normal class times.

Access to student services, including Students Union.

12 Criteria for admission

Candidates must satisfy the general admissions requirements of the programme, which are as follows:

Minimum 2(ii) Honours degree from a UK University or equivalent in a relevant subject.

Alternative Entry Routes

Students who do not hold the standard entry requirements may be considered for admission provided they can satisfy the Course Director and relevant Theme tutors that their qualifications and/or industrial experience are equivalent to that attained through the completion of an appropriate honours degree programme.

13 Evaluation and improvement of quality and standards

Committees:

Course Committee
Board of Studies
Examination Board
Learning Management Committee (LMC)
Learning Quality Committee (LQC)
Faculty Board
Academic Quality and Support

Mechanisms for review and evaluation:

Review and validation events
Annual Monitoring
Student feedback questionnaires
Annual staff appraisal
External Examiners' Reports
Course team meetings and Away Days

14 Regulation of assessment

Students are issued with copies of the University's Standard Postgraduate Assessment Regulations on commencing the course, and individual and collective guidance is given by academic staff on their operation at appropriate times throughout the course.

Standard Postgraduate Assessment Regulations have been reviewed and comply with the National Qualifications Framework.

To qualify for a **Postgraduate Diploma** a student must successfully complete all required assessments and obtain a minimum of 120 credits of which at least 90 must be at level 7. The pass-mark in all modules is 40%.

The award of **Postgraduate Diploma with Commendation** will be made to students who satisfy the requirements for the award and achieve an overall average mark of 60 – 69% at the first sitting in the marks awarded for Stage 2 themes equivalent to at least 60 credits.

The award of **Postgraduate Diploma with Distinction** is made to students who achieve an average mark of 70% at the first sitting in the marks awarded for stage 2 themes, which is equivalent to at least 54 credits.

To qualify for a **Master's Degree** a student must successfully complete all required assessments and obtain a minimum of 180 credits of which at least 150 must be at level 7. The pass-mark in all modules is 40%.

The award of **Master's Degree with Commendation** will be made to students who satisfy the requirements for the award and achieve an overall average mark of 60 - 69% at the first sitting in the marks awarded for Stage 3 equivalent to at least 60 credits.

The award of **Masters Degree with Distinction** is made to students who achieve an average mark of 70% at the first sitting in the marks awarded for stage 3, which is equivalent to at least 60 credits.

External Examiners are appointed. Their work includes:

- Reviewing coursework assignments and assessment criteria
- Approving examination papers
- Monitoring standards through moderation of completed assessments
- Attending Examination Boards
- Participating in the course development processes.

MSc in Data Networks and Security Research

Student Guide

Background

The course is designed for those individuals who wish to follow a research career in either academia or in commercial R&D. The course provides a blend of Data Network Design, Network Security along with research methods and research proposal development.

The UK communications industry is one of the largest established in the world, influencing all business sectors. Open telecommunications have encouraged innovations and competitive products and services. To stay ahead, companies need to be aware of the latest technologies, products and services and how to utilise them. On completion of this course you will be ideally positioned with your research skills to offer assistance to these companies.

CISCO systems are a multinational organisation specialising in the supply communications network technology products and infrastructure. The **tic** is a Super CISCO academies training centre (CATC) and provides training for network professionals throughout Europe, Middle East and Africa. You will have the potential to obtain partial industry accredited qualifications (CCNP, FNS) which will further enhance your career prospects. If you wish to complete this accreditation there will be opportunities after the completion of your MSc.

What does the industry want?

The course reflects increasing use by industry of complex secure communication systems. As well as providing you with a sound research base it will provide you with an insight of how they are designed, developed and enhanced.

Industry requires professionals who are able to take a research based multidisciplinary approach to system design, implementation, test and management.

What will I Study?

You will experience a wide variety of subjects and many different types of learning environment including lectures, tutorials, and computer simulation. The course incorporates a significant amount of practical project work to provide you with an opportunity to develop and apply your knowledge.

The content and structure of the course are designed to produce postgraduates with a broadly based but technologically orientated education with a research capability. The themes are:

- **Postgraduate Study development Unit**
- **Design of Communication Systems I** - Network Design Concepts, Advanced Routing Protocols, WAN Technologies
- **Research Methods**
- **Network Security Systems** - Algorithms, Implementation of secure network systems
- **Research Proposal Development**
- **Master's Project**

Who will teach me?

The course team is at the Technology Innovation Centre, at the University of Central England. In addition, external industrialists may be used to provide guest lectures/seminars.

Am I just going to be taught from a Classroom?

No. Fully equipped state of the art Laboratory facilities, are available for you. A hands-on approach to learning is encouraged using the **tic's** extensive facilities supported by CISCO.

What are my employment prospects?

The Master of Science degree in Data Networks & Security Research will provide you with the expertise and knowledge required for research based career in the specification and design of secure network systems.

Typical routes of employment that could lead from this programme include:

- Academic Research, Further Study or Commercial R&D
- Network Developers and Designers

How do I apply?

University Faculty: Technology Innovation Centre
Course Length: 1 year and 1 term full-time and normally 2¹/₂ years part-time
Location: Millennium Point, Curzon Street, Birmingham B4 7XG
Enquiries: Information Officer (at the above address) or at enquiries@tic.ac.uk or Telephone: (+44) (0)121 331 5400

MSc in Data Networks & Security Research

Employers' Guide

Introduction

The course is designed for those individuals who wish to follow a research career in either academia or in commercial R&D. The course provides a blend of Data Network Design, Network Security along with research methods and research proposal development.

The Technology Innovation Centre, part of the University of Central England, offers a portfolio of engineering based programmes. This course focuses on the Design of Secure Data Network systems.

The course is designed to reflect growing demand in industry of complex software and communication systems, it will provide the student with an insight of how they are designed, developed and enhanced in order to provide competitive advantage and gain market share.

Facilities / Partnerships

Students following the programme have access to state-of-the-art facilities at the Technology Innovation Centre (tic). The course is based within the Technology Innovation Centre, which is a part of the University of Central England. The Technology Innovation Centre is located within Birmingham's prestigious Millennium Point building, a £multimillion development providing some of the best resources and facilities in the country and the cornerstone of Birmingham's Eastside Learning Zone. The course makes full use of industrial visits and guest speakers encompassing a wide range of expertise. The tic has a close partnership with CISCO systems. The tic has Super CATC (CISCO Authorised Training Centre) status and provides training for network professionals throughout the Europe, Middle East and Africa. Students studying on this course will have the potential to obtain partial industry accredited qualifications (CCNP, FNS) which will further enhance their career prospects. Students can complete this accreditation after the completion of their MSc.

Programme Aims

The course aims to produce skilled researchers in the field of Network Design and Security capable of researching, designing and managing projects across organisations utilising the latest tools and technologies.

The Curriculum

Students will experience a wide variety of subjects and many different types of learning environment including lectures, tutorials, and computer simulation. The course incorporates a significant amount of mini project work to provide you with an opportunity to develop and apply your knowledge.

The content and structure of the course are designed to produce postgraduates with a broadly based but technologically orientated education with a research capability. The themes are:

The Data Network & Security course offers the following themes:

- **Postgraduate Study development Unit**
- **Design of Communication Systems I** - Network Design Concepts, Advanced Routing Protocols, WAN Technologies
- **Research Methods**
- **Network Security Systems** - Algorithms, Implementation of secure network systems
- **Research Proposal Development**
- **Master's Project**

Expected Outcomes

Postgraduates can be expected to have acquired extensive knowledge and hands-on practical experience of analytical skills, communication system design implementation and management.

Specifically they will be able to:

- Apply sound research principles to the analysis, design and implementation of solutions based on user requirements and specification.
- Argue rationally and draw independent conclusions based on a rigorous, analytical and critical approach to demonstration and argument.
- Synthesise theory and practice to design/implement a range of solutions
- Assess and resolve competing issues such as resources.
- Construct a fully researched and referenced technical reports, which evaluate both technical and management issue. This will involve the use of a variety of IT tools.
- Demonstrate, through analysis of a specified problem, a high level of competence and understanding of the data manipulation and information presentation and delivery.
- Relate to industry and commerce and apply new technologies and techniques to solve present and future problems concerning not only UK but also international companies.
- Skills required, working effectively within a team or plan, undertaking and presenting an individual research and development project.

Contact Details

University Faculty: Technology Innovation Centre
Course Length: 1 year full-time and normally 2¹/₂ years part-time
Location: Millennium Point, Curzon Street, Birmingham B4 7XG
Enquiries: Information Officer (at the above address) or at enquiries@tic.ac.uk or Telephone: (+44) (0)121 331 5400