

Programme Handbook

MSc MICROELECTRONIC REALISATION

May 2003, amended October 2004

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1. INTRODUCTION

This postgraduate programme is hosted by the Department of *Computing and Electronic Technology* and is taught by distance learning over the internet (e-learning). It is studied part time and completion of the MSc normally takes three years four months.

The programme operates within Bolton Institute's postgraduate modular framework and conforms to the regulations and procedures described in the document *Assessment Regulations for the Postgraduate Modular Framework* which is available from the Bolton Institute website under *Academic Quality and Audit*.

This handbook provides a description of the programme and associated key information. It is intended to provide a first point of reference for students and staff.

2. PERSONNEL

Contact information for all staff at Bolton Institute is available at the Staff Directory in the "Staff Matters" section of the home page at www.bolton.ac.uk

The following staff have particular responsibilities for the management, delivery and support of the programme:

2.1. Administration

Mrs Hilary Birtwistle	Head of Academic Administration
Ms Angela Douglas	Academic Administrator
Mrs Linda Holland	Distance Learning Administrator

2.2. Academic Staff Tutors for Modules and MSc Projects

Roy Attwood
Neil Cole
Dr Dennis Dodds
Alan Edgar
Dr Gerard Edwards
Dr Adel Elsayed
Dr Ron Hood
Murray MacCallum
Frank Mackin
Jeff Ormerod
Prof. Ted Pritchard
Abdul Razak
Clive Robinson
Prof. Peter Saul
Martin Tarr

2.3. Other Academic Responsibilities

Dr Andrew Hartley	Head of Department
Jeff Ormerod	Academic Programme Leader
Neil Cole	Applications Software Development and Support
Dr Ron Hood	MSc Projects Co-ordinator
Roy Attwood	Postgraduate Programmes Co-ordinator
John Hall	Chairman of Examination Board
Zubair Hanslot	Chairman of Examination Board
Dr Steve Taylor	External Examiner

2.4. Support Staff

Roger Kirkman	Networks and Applications
Ian Charlson	Networks (Networks and Systems)
John Bird	Supervisory Technician
Dave Reardon	Computer Technician
Alan Walker	Computer Technician
Mohammed Zaffar	Computer Technician
Ms Angela Tinwell	Web Development Officer
Chris Frost	Web Development Officer
Steve Crimes	Specialist Subject Librarian (Learning Resources)
Ms Katie Jennings	Disability Officer (Student Centre)
Arnold Weldon	Student Counsellor (Student Centre)
Ms Viv Firth	Finance for Students (Finance Office)

(various)

Learning Support help desk

3. OPENING HOURS OF RELEVANT OFFICES

Administrative office hours for the programme are from 9.00 a.m. to 5.00 p.m Monday to Friday, UK time. Contact can be made by telephone, email or post. Students who are within travelling distance of Bolton are welcome to call at the office personally by appointment.

Academic queries should be directed to the tutor for the module concerned who will inform you of the best time to contact them. Academic queries of a more general nature should be directed to the Distance Learning Administrator.

The *Student Centre* at Bolton Institute provides an integrated support service for all students. The opening hours are stated on the website. Contact details are:

Tel. +44 (0)1204 903733

E-mail: student-info-centre@bolton.ac.uk

Web: www.bolton.ac.uk/studentguidance/

Bolton Institute's corporate *Student Handbook* is updated annually and contains general information that is applicable to all students. It is available online at the website given above.

The opening hours of the library are given on the home page of *Learning Support and Development* at www.bolton.ac.uk/learning/

4. POLICIES AND PROCEDURES

Bolton Institute's Student Handbook is posted annually to every distance learning student by the Student Centre as part of the enrolment or re-enrolment process. It can also be referred to online from the Student Centre website, www.bolton.ac.uk/studentguidance/

The following policies are covered in the handbook:

- student entitlement
- equal opportunities
- race equality
- disability
- international students
- research
- environment
- health and safety
- drugs and alcohol
- smoking

The following procedures are covered in the handbook:

- comments and complaints
- student discipline
- mitigating circumstances

The following regulations are covered in the handbook:

- general
- examination
- amanuenses
- computing facilities

In addition there is general information about the Institute and the implications of the Data Protection Act.

5. COMMUNICATION SYSTEMS

As this is an e-learning programme, the normal channel for communications is email. Students can contact tutors, administration and support staff at any time this way; staff will always try to respond promptly, sometimes following up with a telephone call to cover the matter in greater depth and reduce the time needed for a two-way discussion. Support staff are available during published office hours.

Where appropriate, videoconferencing facilities may be utilised. The presentation element of the MSc Project is frequently delivered and assessed through this medium.

Web pages provide essential information for both prospective and enrolled students on the programme. Links to other information sources are also included.

Communication between tutors and students and between students is encouraged by the provision of distribution lists for each module. Students can choose whether to include the tutor in the discussion.

Design activities on the programme are supported by Electronic Design Automation (EDA) software tools running on servers located centrally at Bolton Institute. Tutors may choose to use the "shadowing" feature whereby both student and tutor see the same design screen and the student temporarily assigns control to the tutor.

It is the responsibility of each student to ensure that they have access to a PC which is suitably connected to the internet via an Internet Service Provider (ISP). A minimum specification for the PC and the connection is provided. Students are required to install the communications client software on their local PC to facilitate remote access to EDA tools.

Students are represented at meetings of the Programme Committee and have the opportunity to raise any issues.

6. PASTORAL SUPPORT AND GUIDANCE

If a student has a personal or medical problem that is likely to affect their studies they should inform the Distance Learning Administrator who will then decide on any further action. This may involve informing the tutor(s) for the module(s) currently being studied, or the Programme Leader, or it might involve calling upon the relevant personnel in the Student Services Department. Here, trained counsellors are available to offer appropriate help and guidance. Assistance from the Student Centre will remain confidential unless the student requests that the tutors are informed.

If the Distance Learning Administrator judges that mitigating circumstances should be brought to the attention of the Examination Board, the appropriate form will be posted to the student for completion and return.

7. ACADEMIC SUPPORT AND GUIDANCE

The first contact for any academic problem is the Module Tutor or, in the case of the MSc Project, the Project Supervisor. Tutors can be contacted by telephone or e-mail. The intention is to resolve all problems quickly and efficiently with minimal delay to the student's study programme.

Students are encouraged to discuss problems with their peers as well as with the tutor. Experience has shown this to be a useful way of solving problems and encouraging suggestions for improvements to the courseware.

Academic support and guidance is available from:

Module Tutors - members of academic staff responsible for the day-to-day tutoring of a particular module. The module tutor organises the module teaching structure, sets the module assessments, ensures that all students on the module are aware of assessment requirements and acts as the identified individual to consult over academic problems in the module.

Programme Leader - able to advise on the programme as a whole and is also responsible for advising on the choice of modules and checking any module prerequisites.

Library and Online Learning Resources. Special arrangements apply for students of distance learning courses. These are detailed in a web page associated specifically with the course and also on the distance learner page provided by the *Library and Learning Resources* Unit. www.bolton.ac.uk/learning/

8. ASSESSMENT PROCEDURES

The programme comes under the scope of Bolton Institute's postgraduate modular framework, the regulations for which are defined in the document *Assessment Regulations for the Postgraduate Modular Framework*, published by the Academic Quality and Audit Unit.

8.1. Submission of Assignments

Assignments may be submitted by any method, including e-mail, fax and surface mail. E-mail is preferred. Receipt of assignments will be acknowledged by email, normally within 24 hours. The preferred file format(s) for each module will be specified in the module overview by the author/tutor. An electronic copy of each assignment will be retained for inspection by the External Examiner.

All coursework, which is submitted for assessment will be subject to deadlines. Past experience has shown that good students appreciate the opportunity this gives to improve their time management. If work is submitted after the published deadline, one of two penalties will apply, as follows:

Up to two weeks late: the assignment will be marked as normal and the tutor's comments and feedback will be relayed back to the student, but one grade will be deducted. The Exam Board will consider mitigating circumstances in accordance with the procedure outlined in the Bolton Institute Student Handbook.

More than two weeks late: the assignment will be marked as normal and the tutor's comments and feedback will be relayed back to the student but the mark recorded for this work will be zero. The Exam Board will consider mitigating circumstances in accordance with the procedure outlined in the Bolton Institute Student Handbook.

8.2. Submission of Mitigating Circumstances

The procedure described in the Bolton Institute Student Handbook is adhered to. Students who consider their performance in assessment has been affected by personal circumstances, such as illness, should complete a mitigating circumstances form. This, together with supporting documentary evidence, should be submitted to the Chairman of the Examination Board for consideration at the next meeting.

8.3. Marking and Feedback Policies and Procedures

Written feedback on each assignment is supplied by electronic means, normally within two weeks of the submission date.

8.4. Publication of Results

The grade for each assessed piece of work is made known to the student at the same time as the feedback for each assignment. After the final piece of assessed work has been marked, the overall mark for the module is calculated and made known to the student with clear advice that the mark is provisional until it has been accepted at the next meeting of the Examination Board.

8.5. Examination Board

The programme conforms to the requirements of the Bolton Institute Modular Masters framework. The Examinations Board is authorised to assess student performance in accordance with the assessment regulations and to assess any referred* or deferred* work. It works under the guidelines and terms of

reference specified by the Academic Affairs Unit of Bolton Institute. The rights, responsibilities and conduct of the Board shall be in accordance with the current policies and regulations of Bolton Institute. The Examinations Board meets twice a year to consider student progress and make recommendations for an award.

* these terms are explained in Assessment Regulations for the Postgraduate Modular Framework

After every meeting of the Examination Board each student will be issued with a transcript detailing the results for each assessment studied to date. Any requirement for referred work to be re-submitted will be mentioned and the deadline for submission clearly stated.

8.6. Reassessment

Because all assessment is by coursework, there is no need for the "repeat" outcome from an Examination board and all reassessment is covered by "refer" or "defer". The Board of Examiners shall not withhold permission for a student to be reassessed without good cause.

8.7. Transfer of Relevant Credits

Under the CEESI Memorandum of Agreement, relevant credits awarded by one or more of the CEESI partner institutions are transferable to or from Bolton Institute.

8.8. Exemptions for Credits Obtained Outside the CEESI Scheme

Where the student is able to show that a high proportion of a module syllabus has been satisfactorily assessed elsewhere, an exemption may be granted.

See also **Assessment Strategy**

9. MODULE COMPLETION AND WITHDRAWALS

9.1. Completions

Modules should be completed within the defined study period (including the extension period allowed for late submission). Under extraordinary circumstances such as tutor unavailability or central resource unavailability, submission dates may be extended by the module tutor or the Programme Leader.

9.2. Withdrawals

Students who wish to withdraw, transfer or suspend their studies on the programme must contact the Programme Leader immediately. The Programme Leader will be able to counsel the student regarding current and future options. If the student has a personal problem the Programme Leader will be able to offer guidance, with the assistance of counsellors from the Student Centre if necessary. It is the responsibility of the Programme Leader to authorise and sign the relevant form to withdraw the student from the programme or suspend studies.

9.3. Retention of Data

Individual student files (including academic/character references) will be held for a period of ten years and then destroyed.

10. PROGRAMME AIMS AND INTENDED LEARNING OUTCOMES

Please refer to the programme specification document which forms the next few pages.

10.1. PgCert/PgDip/MSc Microelectronic Realisation Programme Specification

Qualification

Three qualifications are possible, but for any individual only one qualification will be awarded. The three are: Master of Science (MSc), Postgraduate Diploma (PgDip) and Postgraduate Certificate (PgCert).

Programme Title

Microelectronic Realisation

UCAS Code

Not applicable

Programme Type

Part time taught masters

Main Purposes and Distinctive Features of the Programme

The programme provides a system level approach to the design and implementation of products incorporating microelectronics. Traditionally in large organisations the related activities of integrated circuit design and printed circuit board design have been undertaken by different design engineers and teams. In some organisations one or both activities may be sub-contracted and in smaller organisations the same individual may undertake both activities. In all cases the successful synthesis of a microelectronic design requires a knowledge and understanding of the related design considerations appropriate to both activities. The chip designer may produce a perfectly working device which subsequently fails when incorporated into an electronic system due to an inappropriately specified circuit board layout. Similarly the board designer can induce a system malfunction by failing to understand the requirements and characteristics of customised silicon technology.

As integration levels continue relentlessly upwards, operating speeds rise and board technology becomes ever more complex, the potential for failure increases significantly. Should failure occur, the resulting problems associated with product reliability will have serious time/cost implications for the design and development cycle.

The programme provides a balance of modules from the two other pathways: *Advanced Microelectronics* and *Electronic Design Realisation*. The microelectronics industry is maturing to the point where not only do both these disciplines require higher levels of expertise, but also the practical implementation of this expertise is converging. The programme therefore is expected to be of general interest to all electronic engineers and of particular value to those with a specific involvement in system level product design.

Aim

The aim of the *Microelectronic Realisation* programme is to equip participants with the skills and knowledge necessary to design, implement and manage projects incorporating microelectronic systems.

Objectives

The objectives of the programme are:

- to increase the knowledge and skills of electronics system engineers by high quality supported learning undertaken in the home outside normal working hours;
- to provide part-time professional development in the integration of microelectronic technologies and systems for people working in industry;

- to enhance the competitiveness of companies by providing postgraduate education for their staff outside normal working hours;
- to provide specialist education leading to postgraduate qualifications;
- to provide students with a facility for continuing professional development, as urged by the engineering institutions and the Engineering Council.

On completion of the programme* successful participants will have:

- researched the areas of microelectronics, printed circuit board (PCB) design, fabrication, assembly and test, as practitioners and readers;
- acquired a secure understanding of subject knowledge in their selected areas of study;
- acquired skills and abilities necessary for them to pursue the demands of their chosen programme successfully;
- applied subject knowledge, skills and abilities so gained to their own professional context in order to address areas of concern and development needs in an informed, justifiable manner;
- made informed comment on the applicability, relevance and usefulness of theories, concepts, models, methodologies and techniques applied to practice;
- evaluated, reviewed and reflected upon their assignment / project work, and provided a reasoned identification of aspects requiring further development.

* *with acknowledgements to Bolton Institute Department of Education*

Distinctive Features

- The programme provides a flexible study regime designed to be suitable for people who are in full time employment and likely to move around.
- It includes an unusual set of business modules that have been written specifically for those working in the electronics industry.
- The modules cater for managers wanting to widen their knowledge of technology and technical employees wanting to widen their knowledge of business matters.
- The programme is strongly influenced by the needs of industry.
- The programme is unique in that it "takes the design lab to the home". The latest in client server software enables delegates to use powerful industry standard electronic design automation (EDA) software remotely from home just as if they were working in an industrial design lab.
- A unique feature of the programme is the practical experience it gives in integrated circuit design and PCB design. Special software enables the student's PC to run Unix applications on the remote server. Digital, analogue and mixed signal devices are supported, as is top down design using VHDL and Verilog. Guidance on how to use the software is provided by means of worked examples where each step is described, interspersed by pictures taken from the screen. The recommended way of learning from these *design walkthroughs* is to split the screen in half, keeping the explanatory text and screen images visible in one window while running the EDA software alongside.
- The MSc project element is normally undertaken within the company, supported by an industrially based tutor as well as an academic tutor.

Learning Outcomes

Knowledge and understanding in the context of the subject

Students of the programme should know about:

- K1 microelectronic technologies and applications
- K2 printed circuit board technologies and materials, manufacturing of electronic systems
- K3 Electronic Design Automation (EDA) tools
- K4 signal integrity concepts and analysis
- K5 relevant and associated technologies
- K6 relevant business and management methods and practice

Subject-specific practical/professional skills

Students of the programme should be able to:

- S1 define and specify appropriate design tools for a particular application
- S2 select, evaluate and utilise appropriate techniques and technologies to design microelectronic circuits
- S3 select, evaluate and utilise appropriate techniques and technologies to design and test PCBs
- S4 prepare appropriate documentation and deliver relevant presentations
- S5 project planning for microelectronic systems

S6 management for microelectronic systems

Cognitive skills in the context of the subject

Students of the programme should be able to:

- C1 critically evaluate a set of requirements for a microelectronics design or realisation project
- C2 construct an appropriate specification from a given set of requirements.
- C3 derive a suitable commercial implementation plan for a microelectronics or realisation project
- C4 design and test microelectronic systems

Other skills (e.g. key/transferrable) developed in subject or other contexts

Students of the programme should be able to:

- O1 use a range of computing and IT facilities
- O2 communicate effectively orally and in writing
- O3 pursue independent study
- O4 manage time and resources effectively
- O5 engage in continuing professional development taking account of technological change and innovation.
- O6 develop research skills.

The table below maps learning outcomes to the modules. Note that the MSc Project will be specified to ensure that all the learning outcomes are covered.

Learning Outcome	MODULES																			
	AMI 4233	AMI 4225	AMI 4441	AMI 4407	AMI 4409	AMI 4614	AMI 4655	AMI 4622	AMI 4634	AMI 4822	AMI 4966	AMI 4812	AMI 4813	AMI 4817	AMI 4957	AMI 4088	AMI 4040	AMI 4019	AMI 5001	
K1	X	X				X	X	X	X		X				X			X	X	
K2												X	X	X	X					
K3	X		X	X	X					X	X		X		X				X	
K4										X	X				X				X	
K5	X	X					X	X	X			X	X	X					X	
K6																X	X	X	X	
S1	X		X	X	X					X	X		X		X				X	
S2	X		X	X	X	X					X		X	X	X				X	
S3		X								X	X	X	X	X	X				X	
S4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
S5	X												X		X		X		X	
S6													X		X		X	X	X	
C1	X		X	X	X								X		X			X	X	
C2	X			X	X						X		X		X				X	
C3	X												X				X	X	X	
C4			X	X	X	X	X			X	X			X	X				X	
O1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
O2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
O3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
O4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
O5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
O6	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

Qualities, Skills & Capabilities Profile

Cognitive

- Explore and critically evaluate a range of relevant theories and concepts
- Relate theory to professional practice
- Undertake in-depth academic study that is professionally relevant
- Undertake in-depth academic research relevant to the topic
- Evaluate systems and ideas; design and synthesis
- Applied problem solving; analysis of information; flexibility of thought

Practical

Acquire and use research and scholarship skills for masters level study
 Electronic Design Automation tool specification design and utilisation
 Design microelectronic circuits
 Project management, human resource management; financial skills

Personal & Social

Organisation and time management
 Self motivation; develop skills in problem solving

Other

Project proposals, feasibility studies and technical report writing
 Research techniques; investigation; information gathering
 Presentation techniques

Duration and Structure of Programme / Modes of Study / Credit Volume of Study Units

The mode of study is part time distance learning over the internet. All the taught modules within this programme are at level HE7 and rated at either 10, 15 or 20 credits. The MSc Project is rated at 60 credits. One credit is equivalent to 10 hours of notional learning time.

Completing the requirements of the Postgraduate Certificate normally takes fifteen months by part time study. The Postgraduate Diploma normally takes two and a half years and the MSc normally takes three and a half years.

Code	Module title	Level	Credits	E=Essential A=preferred-option B=business option O=option O2=manufacturing option	Prerequisites (* = advised but not essential)
	Technology Review				
AMI4233	Microelectronic Technologies and Applications	HE7	15	O	AMI4202*
AMI4225	MEMS and MCM Technologies	HE7	15	O	
	EDA Tools and Design Skills				
AMI4441	Advanced Electronic Design Automation	HE7	20	E	AMI4233*
AMI4407	Digital Integrated Circuit Design	HE7	15	E	AMI4441
AMI4409	Analogue and Mixed Signal IC Design	HE7	15	E	AMI4441
AMI4614	Communications IC Architectures	HE7	15	O	AMI4441
	Microcontrollers and DSP				
AMI4655	Microcontrollers	HE7	20	O	
AMI4622	Digital Signal Processing	HE7	15	O	
AMI4634	DSP in Speech Technology	HE7	15	O	AMI4622
	Signal Integrity, EMC and LVD				
AMI4822	Design for Signal Integrity	HE7	15	E	
AMI4966	Design for EMC and LVD	HE7	15	O	
	Design and Manufacture of Electronic Systems				
AMI4812	Material and Processes for EDR	HE7	20	E	
AMI4813	Design for eXcellence	HE7	15	O	AMI4812*
AMI4817	Design for Thermal Issues	HE7	15	O	
AMI4957	Test Strategies	HE7	15	O	
	Business and Management				
AMI4088	Industrial Management	HE7	10	B	
AMI4040	Project Management for Microelectronics	HE7	10	B	
AMI4019	Business Issues of Microelectronics	HE7	10	B	
	MSc Project				

AMI5001	MSc Project	HE7	60	E	60 credits
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To obtain the award of PgCert *Microelectronic Realisation*, students must gain 60 credits from any of the modules listed, including *Advanced Design Automation* and *Materials and Processes for EDR*.

To obtain the award of PgDip *Microelectronic Realisation*, students must gain 120 credits from the list of modules, subject to the two constraints listed here:

- a) Students must pass all five modules marked E.
- b) Students must pass at least one of the modules in the group "Business and Management", marked B.

The Master of Science (MSc) award has similar requirements to the Postgraduate Diploma but in addition it involves completing and writing up a substantial project which is rated at 60 credits. The project can be started any time after 60 credits have been gained from the taught modules.

Wider Study Choices

Students may import up to 50% of the required credits for an award from approved CEESI taught modules delivered by other CEESI partner universities. i.e. students may import up to 30, 60 or 90 credits for the award of PgCert, PgDip and MSc respectively. CEESI approved modules are listed on the website at: www.ceesi.ac.uk

Provision for Modules at Level HE6

The national qualifications framework for higher education allows a limited amount of study at level HE6 to be included within a postgraduate qualification. No such modules formed part of the *Advanced Microelectronics* programme when it was validated but, if they were added in future, no more than 20 credits at level HE6 could contribute to a PgCert and no more than 30 credits at level HE6 could contribute to a PgDip or MSc.

Learning, Teaching and Assessment Strategy

Learning and Teaching Methods - Taught Modules

Each of the taught modules includes periods of formal study, directed learning, review and assignment work. These aspects are described in the next four paragraphs.

The prescribed formal study for each module comprises a series of units, each of which is downloaded from the internet. Each unit is likely to include references to internet sites, books and journals and sometimes interactive work. Units may also involve periods of design using electronic design automation (EDA) software remotely. Module tutors give direction and provide advice and help throughout as appropriate.

Directed learning gives the opportunity to explore the subject to greater depth using web sites, books and library resources. Familiarity with EDA software and competence in its use arises only from repeated exposure and time to experiment. Where modules involve EDA tools the student will be encouraged to spend time exploring the packages online as part of the directed learning. Module tutors give direction and provide advice and help throughout as appropriate.

The review aspect is achieved through self-assessment questions (SAQs), for which worked solutions are available, and longer exercises. Students are encouraged to discuss any difficulties with the module tutor.

Assignment work is part of assessment and is described under section 9, below.

Learning and Teaching Methods - MSc Project

The MSc Project is the distinguishing feature of a Masters Degree over a Postgraduate Diploma. It normally takes a year to complete by part time study and is intended to develop competence in planning, gathering information (research), analysis, design and communication. The topic chosen should include elements of investigation and design/development and offer scope for the student to work independently at an advanced technical level. During the year the student is expected to submit a project plan and an interim report, and to give a presentation. Finally the work of the project is presented in full in a formal bound dissertation.

Assessment Methods

The taught modules are assessed by written work (assignments) and by practical projects involving EDA tools. Tutors provide written formative feedback from each piece of assessed work. There are no formal written examinations. Written assignments are normally received by email but they may be submitted by any means, including by post or fax. The assessment criteria for each module is provided in the individual module specifications. The MSc Project is assessed in six elements, as detailed in the specification for the MSc Project.

Assessment Classification System

The assessment classification and criteria are described in sections 1.3 and 1.4 of the Bolton Institute *Assessment Regulations for the Postgraduate Framework* (document PO14).

Degree Classification Bands

The requirements of each of the three possible postgraduate awards are detailed in section 2.7 of the Bolton Institute *Assessment Regulations for the Postgraduate Framework*. Section 2.7.3 states that the Examination Board may award an "MSc with distinction" where the average mark for all taught modules is 70% or above and the mark for the MSc Project is also 70% or above. In all other cases classification is not offered.

Other Information

Date Programme First Offered

The programme commenced in October 2003. Most of the modules for this programme were first taught within the programme *Advanced Microelectronics for Industrialists* which commenced in November 1997.

Admission Criteria

The minimum requirement for registration directly onto the MSc is an honours degree in a relevant subject. Applicants who do not meet this requirement may be able to register initially for a Postgraduate Diploma and having gained that qualification, transfer their enrolment to the MSc for the final year. There is no additional cost involved in making the transfer.

The normal minimum entry qualification for a Postgraduate Diploma or Postgraduate Certificate is an ordinary degree or other higher qualification (e.g. HND/HNC) together with appropriate experience but in exceptional cases substantial relevant experience alone may be acceptable.

Applicants based overseas are required to sign a declaration stating that various technical criteria are met regarding their internet connection and indicating their level of proficiency in reading technical english.

Non-standard Entry

Candidates who do not meet the standard conditions can be considered against criteria for exceptional entry to the Postgraduate Diploma in the first instance.

Indicators of Quality and Standards

The programme has been validated by a panel of external subject specialists and is subject to an annual quality enhancement programme. All assessed work is inspected by an External Examiner.

11. PROGRAMME STRUCTURE AND CONTENT

The programme structure and content are detailed in section 8 of the Programme Specification which forms part of section 10 of this handbook. Likewise, the map linking modules to learning outcomes is provided in section 6 of the Programme Specification.

The module descriptors in Section 18 of this handbook include learning outcomes, indicative syllabuses and a brief indication of the assessment criteria for each module.

11.1. QAA Level Descriptors

In accordance with the QAA framework level descriptors, holders of a qualification at masters level will have demonstrated:

- a) a systematic understanding of knowledge and a critical awareness of current problems and/or new insights, much of which is at, or informed by, the forefront of their academic discipline, field of study, or area of professional practice;
- b) a comprehensive understanding of techniques applicable to their own research or advanced scholarship;
- c) originality in the application of knowledge, together with a practical understanding of how established techniques of research and enquiry are used to create and interpret knowledge in the discipline;
- d) conceptual understanding that enables the student:
 - i. to evaluate critically current research and advanced scholarship in the discipline and
 - ii. to evaluate methodologies and develop critiques of them and, where appropriate, to propose new hypotheses.

Typically, holders of the qualification will be able to:

- a) deal with complex issues both systematically and creatively, make sound judgements in the absence of complete data, and communicate their conclusions clearly to specialist and non-specialist audiences;
- b) demonstrate self-direction and originality in tackling and solving problems, and act autonomously in planning and implementing tasks at a professional or equivalent level;
- c) continue to advance their knowledge and understanding, and to develop new skills to a high level; and will have:
- d) the qualities and transferable skills necessary for employment requiring:
 - the exercise of initiative and personal responsibility;
 - decision-making in complex and unpredictable situations; and
 - the independent learning ability required for continuing professional development.

11.2. Level Descriptors

The relevant generic level descriptors from the NICATS criteria are at level 7, reproduced here:

Display mastery of a complex and specialised area of knowledge and skills, employing advanced skills to conduct research, or advanced technical or professional activity, accepting accountability for related decision making including use of supervision.

12. TEACHING AND LEARNING

Most students enrolled on the programme are employed in the electronics industry in some way or at least have some experience of industry. The learning experience is devised to expose students to taking decisions in realistic situations and so equip them for a leading role in the industry. Part of the learning involves exposure to the use of high level industry standard software and assessing its advantages and limitations and also making critical appraisals of the latest technical advances. Throughout the programme the student is encouraged and required to make reasoned and critical assessments and to formulate and execute strategies to overcome problems. The aims, objectives and learning outcomes of the modules reflect this approach.

The prescribed study for each module comprises a series of units, each of which is presented via the internet. Text, images and graphics are the main elements, but where appropriate, interactive devices or audio or video components are used as an aid to understanding, or sometimes for reinforcement. Modules that include tuition in the use of Electronic Design Automation (EDA) software tools include formal instruction presented as a series of design walkthroughs.

Directed learning gives the opportunity to explore the subject to greater depth using web sites, books and library resources. Where modules involve EDA tools, students are encouraged to spend time exploring the packages online as part of the directed learning. This is in recognition of the fact that gaining familiarity with any software and building competence in its use takes a considerable amount of time and can only be achieved through reinforcement brought about by repeated exposure and time to experiment.

Each unit within a module includes opportunities for students to review the material and consolidate their understanding. The self review process is achieved by completing a series of self-assessment questions (SAQs), for which worked solutions are available. Students are encouraged to discuss any difficulties with the module tutor.

The assessment for each module has been devised to allow students to demonstrate the extent to which the required learning outcomes specified for the module have been achieved. However, the course team has avoided isolating coursework as something undertaken solely for assessment. Instead, coursework is made to contribute to the learning process, providing reinforcement and an opportunity for students to receive formative feedback. The overview for each module gives an indication of the time that students are expected to spend on each piece of coursework, and the percentage allocation of marks.

The facility for students to execute software from home means that the modules can include *authentic activity*, which is key to developing skills remotely. The course team has identified five success factors in the effectiveness of the teaching and learning approach:

- incremental approach to building up skills
- reinforcement by concentrating on one design suite
- design walkthroughs build up confidence
- reinforcement through practical exercises (design assignments)
- centralised storage makes it possible for the tutor to monitor progress, diagnose problems and provide instruction ("shadowing").

13. ASSESSMENT STRATEGY

Assessment on the programme is by coursework (assignments) and the MSc Project; there are no formal written examinations. Tutors provide written formative feedback from each piece of assessed work.

There is an emphasis on project work and the development of practical skills. The assignments are constructed to enable students to demonstrate mastery in the understanding and application of the subject rather than recall of information. Examples of the assessment methods employed are:

- **Case studies** assess the student's ability to analyse a given system or environment, draw appropriate conclusions and suggest modifications or enhancements
- **Feasibility reports** assess the student's ability to analyse requirements, construct specifications and devise implementation plans.
- **Research investigations** assess the student's capability to explore new ideas and concepts and relate them to developmental activities.
- **Design exercises** assess the student's practical ability to utilise EDA tools and to apply these creatively and appropriately.

The MSc Project involves planning, project management, research and the application of knowledge and skills in a complex situation. It is assessed by a number of elements, as detailed in the MSc Project descriptor and involves demonstrating oral communications skills in the presentation, writing skills in the dissertation and in-depth knowledge in the viva.

Key/transferable skills are developed throughout the programme by the range of assignments requiring students to undertake research and literature searches, provide written reports and demonstrate competence in the utilisation of IT facilities. The MSc Project requires the student to give a presentation and also involves a viva voce examination.

Most modules are assessed by two or more components which are weighted in the manner prescribed in the module descriptor.

The assessment of each piece of work is disclosed to each student in terms of a grade, as in the table below, while the result for each completed module is notified as a percentage mark.

Work of exceptional quality	70 - 100%	Grade A
Work of very good quality	60 - 69%	Grade B
Work of good quality	50 - 59%	Grade C
Work of satisfactory quality	40 - 49%	Grade D
Unsatisfactory performance	35 - 39%	Grade E (Borderline Fail)
Unsatisfactory performance	0 - 34%	Grade F (Clear Fail)

Definitions of the descriptions in this list are provided in the *Assessment Regulations for the Postgraduate Modular Framework* and are reproduced below for convenience.

Work of Exceptional Quality (Grade A)

Virtually all of the relevant knowledge and/or skills accurately deployed. Excellent and exceptional grasp of theoretical, conceptual, analytical and practical elements. Very effective integration of theory, practice and information in relation to the objectives of the assessment. Substantial evidence of originality and creativity as appropriate to the subject.

Work of Very Good Quality (Grade B)

Most of the relevant knowledge and/or skills accurately deployed. Good grasp of theoretical, conceptual, analytical and practical elements. Effective integration of theory, practice and

information in relation to the objectives of the assessment. Significant evidence of originality and creativity as appropriate to the subject.

Work of Good Quality (Grade C)

Some of the relevant knowledge and/or skills accurately deployed. Adequate grasp of theoretical, conceptual, analytical and practical elements. Fair integration of theory, practice and information in relation to the objectives of the assessment. Some evidence of originality and creativity as appropriate to the subject.

Work of Satisfactory Quality (Grade D)

Some omissions in the deployment of knowledge and/or skills. Some grasp of theoretical, conceptual, analytical and practical elements. Limited integration of theory, practice and information in relation to the objectives of the assessment. Limited evidence of originality and creativity as appropriate.

Borderline Fail (Grade E)

Deficiencies or omissions in knowledge, skills, theoretical, conceptual, practical elements. Limited integration of these in relation to the assessed works objectives. Some relevant content and marginal evidence of skills, knowledge or creativity which could, in the light of overall performance, constitute the basis for a pass grade in the examiner's judgement.

Clear Fail (Grade F)

Little evidence of the knowledge, skills, theoretical, conceptual, analytical, creative or practical elements relevant to the assessment. Mainly irrelevant and/or incorrect information provided. Scant evidence of understanding of the requirements of the assessment.

See also **Assessment Procedures**

14. PROGRAMME MANAGEMENT AND ORGANISATION

Bolton Institute comprises a number of academic departments and support units which work together to ensure that as far as possible every programme of study operates smoothly and every individual learner is catered for and supported effectively.

The internet is a new medium for teaching and learning which places different and sometimes unexpected demands on the academic and support staff. To add to the uncertainty, the demands are gradually changing in response to external influences. Examples of these external influences are: the *Special Education Needs and Disability Act*, widening and faster home access to the internet in the UK and elsewhere, technological developments such as media streaming, mobile internet access, voice over IP, remote access to software, and the way in which expectations of the design, capabilities and navigation standards of internet sites change almost like fashion.

As the number of students enrolling on e-learning courses continues to grow, the programme management and support structures will be monitored and will continue to evolve. New roles have been defined including those of Distance Learning Administrator, Unix Systems Administrator and Web Development Officer.

The main forum for discussing and agreeing changes to the programme is the Programme Committee which meets at least once each term. A separate committee addresses MSc Projects and a third one, the Examination Board, reviews individual progress and confers awards. All the committees and roles involved with managing the programme are described below.

The **Programme Committee** comprises all the module tutors, the Programme Leader, Distance Learning Administrator and two representatives of the student body. It meets at least every term to review the nature, structure and operation of the programme and make appropriate adjustments. This procedure is formalised in the *Quality Enhancement Plan* (QEP) which is proposed, debated and agreed by the committee at the start of the academic year and then monitored throughout the year. The responsibilities of the **Programme Committee** are to:

- Ensure that the programme continues to address its stated aims and objectives, at all times taking account of changing technology and a changing market.
- Oversee the operation of the programme;
- Ensure that the programme is kept up-to-date and relevant;
- Ensure the programme is delivered at an appropriate (high) quality level;
- Ensure that a proper recruitment and marketing policy is implemented;
- Ensure that intellectual property rights (IPR) issues are dealt with appropriately;
- Develop and monitor an annual quality enhancement plan;
- Discuss and specify detailed learning content;
- Ensure that the distance learning approach continues to evolve in a coherent manner;
- Coordinate the development of learning material from internal and external sources.
- Consider the progress of students and determine whether a satisfactory pass rate is being achieved;

The **MSc Projects Committee** reviews all project proposals and decides whether they are suitable for a project at MSc level in this subject area. The committee will consider elements such as the degree of investigation or research, the suitability and originality of the product, the technology proposed, the development involved, likely timescale and cost. The committee is made up of the MSc Projects Coordinator, the Programme Leader and selected members of the teaching staff.

The **Examination Board** is authorised to assess student performance in accordance with the assessment regulations, including any referred or deferred work. It works under the guidelines and terms of reference specified by Bolton Institute's Academic Quality and Audit Unit. The

Examinations Board meets at least twice a year to consider student progress and make recommendations for an award. The terms of reference are:

- To receive recommendations from Tutors and Project Supervisors and to determine stage and final awards for the students.
- To agree and pronounce the arrangements for the re-assessment and to determine the outcomes of any re-assessment.
- To arrive at impartial, consistent decisions using standards similar to those of other institutions of higher education.
- To agree to any proposed changes to assessment procedures.

The **External Examiner** attends the main meetings of the Examination Board and in addition:

- Approve the form and content of assessments
- Inspects and ratifies (or otherwise) marks awarded for assessment.
- Provide a report to the Institute on the assessment procedures and the general quality of the course as requested by the Department of Academic Quality and Audit.

The **Programme Leader** takes overall responsibility for the operation of the programme, especially its academic content and the academic developments under way at any time. The role involves working closely with the Module Tutors,

The **Distance Learning Administrator** and the **Course Coordinator** are together responsible for the day to day operation of the programme including all student issues not directly the concern of a module tutor, liaison with the external examiner, marketing, recruitment, enrolment and organising meetings of the Course Committee and Examination Board.

The **Module Tutors** are the academic staff responsible for guiding students through the learning experience and towards the learning outcomes expected of a module. As such they set and mark assignments and provide formative feedback to the students and are the first point of enquiry for student problems relating to their module. Tutors are likely to take an active role in maintaining the courseware for their module. In many cases they will have played a major part in developing the courseware in the first place.

The **MSc Projects Co-ordinator** is responsible for the overall operation of the project element of the MSc programme, overseeing arrangements for the approval and allocation of projects and their assessment.

15. STUDENT REPRESENTATION AND FEEDBACK

Students are invited to elect two representatives to attend meetings of the Programme Committee where there will always be time set aside for "Student Issues". This provides an effective mechanism for student views and concerns to be discussed and appropriate action taken to address any concerns.

The email distribution lists for each module provide a means for students to discuss day-to-day issues relating to the module as they work through it. They can choose whether to keep the discussion to their peers or involve the Module Tutor.

At the end of each module students are asked for feedback in the form of a questionnaire. An analysis of the responses is helpful to the programme team in making decisions on maintaining and improving the quality, suitability and relevance of all parts of the programme.

16. TEACHING AND LEARNING RESOURCES

16.1. Technical Equipment

Programme delivery relies on centrally supported servers providing access to the web-based teaching material and remote access to specialist software tools. Some modules require students to experiment using technical kits which are posted to them and returned on completion of the module or project.

16.2. Library Resources

Every student will have access to extensive online resources via the *Library and Learning Resources* Unit. Special arrangements have been made to support distance learning students, including access to e-books. The *UK Libraries Plus* scheme gives e-learning students based in the UK the option to borrow books from up to three different university libraries in their locality.

16.3. Student Equipment

Students are expected to have computing facilities available at home which meet a minimum specification including a connection to the internet via a suitable Internet Service Provider (ISP). The PC will need to be configured to run the client software (Citrix MetaFrame) software for remote access to the Institute EDA server.

17. FURTHER INFORMATION

General information for current and prospective students is published on the programme website:
www.ami.ac.uk

General information about Bolton Institute, its courses and the services available to students is published at www.bolton.ac.uk

The home pages of the support units can easily be reached through the "Quick Links" navigation menu.

18. MODULES

18.1. MSc Microelectronic Realisation

		Credits
Technology Review		
AMI4233	Microelectronic Technologies and Applications	15
AMI4225	MEMS and MCM Technologies	15
EDA Tools and Design Skills		
AMI4441	Advanced Electronic Design Automation	20
AMI4407	Digital Integrated Circuit Design	15
AMI4409	Analogue and Mixed Signal IC Design	15
AMI4614	Communications IC Architectures	15
Microcontrollers and DSP		
AMI4655	Microcontrollers	20
AMI4622	Digital Signal Processing	15
AMI4634	DSP in Speech Technology	15
Signal Integrity, EMC and LVD		
AMI4822	Design for Signal Integrity	15
AMI4966	Design for EMC and LVD	15
Design and Manufacture of Electronic Systems		
AMI4812	Materials and Processes for EDR	20
AMI4813	Design for eXcellence	15
AMI4817	Design for Thermal Issues	15
AMI4957	Test Strategies	15
Business and Management		
AMI4088	Industrial Management	10
AMI4040	Project Management for Microelectronics	10
AMI4019	Business issues of Microelectronics	10
MSc Project		
AMI5001	MSc Project	60