

Birmingham City University Technology Innovation Centre

Postgraduate Programme

Programme Specification including Student Guide and Employer Guide

MSc Mechanical Engineering

Date of Course Approval/Review	Current Version Number	Version Date
25 April 2006	2.03	15 May 2008



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 Automotive Engineering Programme Specification, Student and Employer Guides			
Version	Event	Date of event	Authorised by
2.01	Review and Re-Approval	25 April 2006	Dean of Faculty
2.02	Minor changes Board of Studies	13 June 2007	Dean of Faculty
2.03	Minor changes Board of Studies	15 May 2008	Dean of Faculty

PROGRAMME SPECIFICATION MSc Mechanical Engineering

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 <https://web.tic.ac.uk>, (2) in the Course Validation Document, 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	Birmingham City University
2	Teaching Institution:	Technology Innovation Centre
3	Programme accredited by:	N/A
4	Final Award:	MSc
5	Programme Title:	Mechanical Engineering
6	UCAS Code:	N/A
7	QAA Benchmarking Group:	N/A

8 Aims of the programme

Overall, the course aims to provide engineers within the design role in the sector with a rigorous grounding in industrial standard simulation tools. In particular

- To respond to the market need for mechanical engineers competent and skilled in the use of advanced computer modelling and simulation techniques.
- To enable the students to develop the skills required to design and analyse components and systems within the engineering environment.
- To enable active and autonomous learning to be developed through the use of real engineering problems and case study materials
- To develop engineering skills including problem-solving abilities, practical competencies, critical appraisal and communication skills.

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>A defined body of knowledge, relating to the fundamental principles of mechanical engineering 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 design challenges and unfamiliar problems.</p> <p>Design and analysis aspects of the field in respect of Stress Analysis, Dynamics and Vibration Analysis.</p> <p>Analysis and design tools such as Adams Mechanisms, Finite Element Analysis and Solid Modelling techniques.</p> <p>Dynamics and control of mechanical vibrations and systems.</p> <p>Manufacturing processes of new materials</p>	<p>Face-to-face traditional lecture, seminar, tutorial, self-directed study and peer review sessions.</p> <p>Directed independent learning activities are encouraged at all stages of the course.</p> <p>Knowledge and understanding are also acquired through web based curricula and use of collaborative technologies where appropriate.</p> <p>Knowledge and competence assessment is undertaken by tutors and peers, this both formative and summative. This includes seminars, viva-voce, coursework, practical case studies, theory projects, time constrained examinations, and practical assessments.</p> <p>Students are supported beyond the traditional face-to-face delivery by appropriate tools and technologies developed to support collaborative working.</p>

Skills and other attributes

Intellectual / cognitive skills:

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 issues relating to competing demands on resources.

Write fully researched and referenced reports, which evaluate technical issues. This will involve the use of a variety of IT tools.

Demonstrate, in an analysis of a specified problem, a high level of competence and understanding of the data manipulation, information presentation and delivery.

Apply new technologies and techniques to solve present and future industrial and commercial problems locally, nationally and internationally.

Use relevant analytical and modelling techniques to plan and complete a design project.

Apply, where appropriate, software tools for design and analysis.

Teaching, learning and assessment methods used:

Intellectual skills are developed through teaching and learning programme previously outlined.

Analytical and problem solving skills are further developed using a range of appropriate 'real' and 'theoretical' case-studies and problem based learning scenarios.

The course comprises 4 modules, all requiring an element of written work, which will demonstrate the students' ability to apply the knowledge gained to a specific problem. Each Module attracts 30 Credits.

Assessment includes practical work, individual written coursework, group presentations, viva voce, individual and group reports, practical assessments, closed and open book time constrained examinations.

Practical, research and independent learning skills:

Access information from the internet, journals, books, research papers and appraise its suitability for master's level research.

Demonstrate the ability to work autonomously or in a group and accept responsibility for the action taken.

Reflect on personal practice, attributes, both theory and practice and modify approach to maximise learning opportunities as required.

Interpret and critically evaluate knowledge, concepts and ideas and/or forms of creative expression, to deliver a quality product or service.

Apply the knowledge, skills and methodologies of project management to the analysis and solution of complex problems.

Possess a defined body of knowledge, skills and understanding and analyse its relationships with conceptual frameworks and, where appropriate, professional practice.

Draw independent conclusions based on analysis of argument, opinion and data.

Teaching, learning and assessment methods used:

Initiative and independence are fostered throughout, and develop incrementally as the course progresses.

Emphasis is placed 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.

Learners are encouraged to plan their own work schedules and are required to meet strict deadlines.

Learners are required to plan and execute a related dissertation.

Transferable / key skills:	Teaching, learning and assessment methods used:
Elicit the co-operation of others and contribute to team goals	<p>Transferable/key skills are core to the learning strategy of the programme. They are pervasive, and are incorporated into modules 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 module guides.</p> <p>A full range of resources are identified including books, journals as well as locally created material.</p>
Manage time and prioritise workloads	
Make effective oral and written presentations which are coherent and comprehensible to others	
Access and make appropriate use of relevant mathematical, statistical and theoretical information.	
Use various forms of communication and expression, then to employ them selectively, appropriately and effectively according to the requirements of the solution.	
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.	
Identify career opportunities and begin to build a recruitment strategy, including obtaining placement opportunities.	
Show confidence and self-awareness, reflect on own learning, and be self-reliant and constructively self-critical.	

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

The MSc programme is normally studied over one year and one term full-time or two and a half years part-time. Students may, if they wish move between full and part-time modes of attendance. The academic year is divided into semesters of approximately 15 weeks each, which run from September to January and January to June. The course is divided into 5 distinct study units; four modules, (30 credits) and a Master's project (60 credits). Students complete 60 credits at the Postgraduate Certificate stage, 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 module, 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		Credit
Element name		
SIMULATION TECHNIQUES		30
The aim of this module is to provide the industrial standard simulation techniques which enable students to model complex engineering components and systems		
The module will cover a number of specific areas:		
Finite Element Analysis		
Linear Elastic Statics and Modal Analysis. Techniques and methods for checking results. Quality assurance processes. Standards and practices.		
Multibody Dynamics		
The analysis of mechanisms and rigid or semi-rigid bodies connected by joints and other constraints.		
Control Simulation		
Control simulation packages. Control system modelling, step response, time and frequency domain analysis. Response specifications.		
		30
COMPUTER AIDED DESIGN		
The aim of the module is enable the students to utilise and apply analytical techniques associated with the loading of materials and within a structured design environment		

The module will cover a number of specific areas:

Design Tools

Geometric Representation

Computer based design tools. Solid and surface modelling for shape and form.

Functional Behaviour Modelling

Functional behaviour modelling for specification compliance and reliability. Modelling and simulating ergonomic behaviour, mechanism performance and evaluation.

Economic Decision Making

Design Methodologies

Effect of product type on company structures.

The designer's role within an organisation.

Serial v. Concurrent Processes and project organisation

Collaborative working tools and techniques

Project Management considerations

Industrial Design

Knowledge-Based Engineering

Stress Analysis

Complex three-dimensional stress systems

Advanced Experimental Stress Analysis

Award: Postgraduate Certificate (60 credits)

Stage 2	Element name	Credits
	DYNAMICS NOISE AND CONTROL	30
	<p>The module aims to provide the student with the ability to develop and analyse model representations of dynamic and vibrating systems for the purposes of control</p> <p>The module will covers specific areas of:</p> <p>Dynamics Mechanisms analysis and dynamics Contact forces, springs and dampers Automotive and general mechanical engineering components</p> <p>Noise Combining sound pressures, loudness. Masking, weighting networks, sound level meters and their grades. Time-varying sound and noise dose.</p> <p>Control</p>	

Review of block diagram algebra and transfer function modelling
Feedback, feedforward and PID control
State space analysis and modern controller design

NEW MATERIALS AND PROCESSES

30

The module will enable students to utilise new materials and processes in their design by gaining an understanding of the capabilities of the new technologies. There will also be a focus specifically on designing with new materials and the modelling of manufacturing processes.

The module content will include the following specific areas:

New materials and their applications

Surface Engineering, Lightweight materials, Polymers, Ceramics, Metals, Nanomaterials, Smart Materials, Biomimetics, Materials selection

Modern manufacturing methods

Near net shape manufacturing techniques, Control of processes to produce specific material structures, Reactive polymerisation, Ceramics processing, Precision manufacturing, Developments in metal processing techniques and applications, Measurement Nanotechnology

Simulation of Manufacturing Processes

Use of computer-based manufacturing simulation packages as a predictive tool, and as a way of understanding the processes.

Design

Design methodologies to enable incorporation of new materials and processes to the best effect e.g. DFX, design for the environment, concurrent engineering etc.

Business Skills

Management and business practices

Cost benefit and risk analysis – including commercial risk, environmental influences and impacts, project planning, including development, resourcing, monitoring, feedback and updating to accommodate change.

Teamworking – challenges, roles, motivation and leadership, psychometric testing; contribution assessment, emotional intelligence.

Award: Postgraduate Diploma (120 credits)

Stage 3	
Element name	Credit
Master's Project - 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 industrial problem.	60

Award: MSc (180 credits)

MSc Mechanical Engineering

MSc 180 Credits

Master's Project including Project Proposal and Research Plan and the write-up 60 Credits - 600 hours
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PgD 120 Credits

Dynamics, Noise and Control 30 Credits 300 Hours
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New Materials & Processes 30 Credits 300 Hours
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PgC 60 Credits

Simulation Techniques 30 Credits 300 Hours
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Computer Aided Design 30 Credits 300 Hours
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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 student handbook containing information relating to the University, TIC and the modules of study.

A virtual learning environment to support students remotely via collaborative tools and technologies.

An induction programme dealing with orientation and the dissemination of essential information.

A dedicated Learning Centre with open access learning materials, resources and full-time staff specialising in a variety of support areas.

Access to teaching, support and management staff.

Access to the services of the Learning Centre and IT support staff.

Postgraduate website accessed through TIC intranet.

Access to TIC and BCU 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:

Prospective students who hold at least a 2(ii) Honours degree from a UK university or equivalent in a relevant design, technology, engineering or business discipline will be considered for the course.

Students with other qualifications (including overseas) will be considered by the course team in line with admission regulations identified within the Postgraduate Programme Handbook.

Professional qualifications, work experience and non-standard work based qualifications may be considered by the course team for admission to the course.

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
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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 Certificate** a student must successfully complete all required assessments and obtain a minimum of 60 credits of which at least 30 must be at level 7. The pass-mark in all modules is 40%.

The award of Postgraduate Certificate is not differentiated.

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 modules equivalent to 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 modules, which is equivalent to 60 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 the Master's Project, which is equivalent to 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 the Master's Project, which is equivalent to 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 Mechanical Engineering

Student Guide

Background

The engineering industry, particularly within the UK, is facing significant competitive pressures across global markets. The primary strategies for meeting the challenges facing the industry call for innovation in design and manufacturing processes that can be directly incorporated into products. In order to successfully follow required strategies for change, organisations have to make best possible use of all their resources including, and especially, their professional engineering teams. In particular talented, ambitious engineers versed both in current technology and processes and their practical application are required.

What does the industry want?

The programme provides the opportunity to consolidate new developments in technology by providing a strategic and managerial perspective to the advancements in skills and techniques, and changes in business and commercial practice.

What type of work will I do?

The learning support will be provided through the use of tutorials and electronic communication methods. Research, case studies and practical activities will play a significant part of the learning process and assessment. Guest speakers and industrial visits will also form an important part of the learning experience.

The MSc in Mechanical Engineering offers the following modules:

- **Simulation Techniques**
- **Computer Aided Design**
- **Dynamics Noise And Control**
- **New Materials And Processes**
- **Master's Project**

You will experience a wide variety of subjects and many different types of learning environment including lectures, tutorials, individual tutorial support and a significant emphasis on support outside the traditional classroom environment.

The course incorporates a significant amount of mini project work to provide you with an opportunity to develop and apply your knowledge.

One of the aims of the course is to develop active, autonomous learning. The variety of skills and knowledge that you bring to the courses will be developed by a variety of means. As a part of each of the elements of the course you will participate in peer review sessions where your work and the work of others will be reviewed and analysed by fellow students. This simulates reality where critical peer appraisal and collaborative working is integral to organisational viability.

Who will teach me?

The course team is at the Technology Innovation Centre, at Birmingham City University. In addition, external industrialists are used to provide guest lectures/seminars.

Am I just going to be taught from a Classroom?

No. The programme will use visits to various organisations, and introduce relevant industrial speakers to support learning. In addition, as you might expect from the 'technology innovation centre', cutting edge collaborative tools and technologies are used to facilitate learning.

What are my employment prospects?

The Master of Science degree in Mechanical Engineering will provide you with the expertise and knowledge in specialist engineering methodologies complemented with a comprehensive foundation of generic design skills which have ready application in both public and private sector.

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

- Design and performance engineer.
- Development engineer within industry
- Engineering Consultant
- Research degree or Knowledge Transfer Partnership (KTP) Associate

This list is by no means exhaustive but does reflect the broad range of roles you may consider in the next phase of your career development.

How do I apply?

University Faculty: Technology Innovation Centre
Course Length: 1 year + 1 term full-time and normally 2½ 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 Mechanical Engineering

Employers' Guide

Introduction

The Technology Innovation Centre, part of Birmingham City University, offers a portfolio of engineering based programmes. The course focuses on the design and analysis aspects of the field in respect of Advanced Stress Analysis and Dynamics and Vibration. The study programme is developed to support engineers within the design role in the sector by providing an advanced knowledge of new computer based simulation techniques.

Graduates empowered with these engineering capabilities will become valuable leaders/members of any team working to plan and execute engineering projects. Industry actively welcomes professionals who can demonstrate the ability to understand the needs of the whole organisation and beyond, displaying 'joined up thinking.'

Facilities / Partnerships

Students have access to state-of-the-art facilities at the Technology Innovation Centre (**tic**). The course is based within the **tic**, which is a part of the Birmingham City University. The **tic** is located within Birmingham's prestigious Millennium Point building, a £114 million 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.

Programme Aims

The course aims to develop a new generation of mechanical design engineers competent and skilled in the use of advanced computer modelling and simulation techniques. These skills will be developed through the design and analyse components and systems within a general engineering environment.

Students will be introduced to modern computer based tools used within the industry and provide the opportunity for these tools to be applied to realistic problems. Engineering skills including problem-solving abilities, practical competencies, critical appraisal and communication skills will be developed during the projects undertaken throughout the course.

The Curriculum

The MSc in Mechanical Engineering offers the following modules:

- **Simulation Techniques**
- **Computer Aided Design**
- **Dynamics Noise And Control**
- **New Materials And Processes**
- **Master's Project**

Expected Outcomes

Postgraduates can be expected to have acquired extensive knowledge and hands-on practical experience of the analytical skills, business management, design and technical processes that are inherent in mechanical engineering based industries.

A typical postgraduate should have:

- Understanding of advanced mathematical and modelling techniques considered essential to the study of mechanical engineering,
- Knowledge and skills required for the analysis of the strength and performance of advanced mechanical engineering components and systems,
- Awareness of the technological and commercial changes taking place in industry, their influence on patterns of employment in the industry and their wider ethical, legal, social and political implications
- Knowledge of computer simulation packages, their application and uses in a virtual engineering environment,
- Knowledge and skills in the design and performance of advanced modern mechanical engineering systems and their control.
- Knowledge and skills required to work as an effective team member or plan, undertake and present an individual development project.

Contact Details

University Faculty: Technology Innovation Centre
Course Length: 1 year + 1 term full-time and normally 2½ 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