MSc Mechatronics

PROGRAMME SPECIFICATION

1.Awarding Institution: University of Newcastle upon Tyne

2.Teaching Institution: University of Newcastle upon Tyne

3.Programmes Accredited by: None

4.Final Award: M.Sc.

5.Programme Titles: M.Sc. in Mechatronics

6.UCAS codes: N/A

7.QAA Benchmarking Group N/A

8. Date of production / revision **July 2004**

9 Programme Aims

- To enable and assist suitably qualified graduates from a range of engineering backgrounds to

  develop and widen their knowledge base in mechatronics engineering to Masters level standard,

  develop generic problem solving skills applicable to current, mainstream mechatronic engineering systems,

  achieve more in-depth expertise in selected areas of mechatronic engineering,

  engage in the planning, execution and written/oral presentation of an extended, industrially research orientated project.

- To produce Master level engineering graduates who are able to participate effectively in a wide variety of industrial and/or research environments in the field of mechatronic engineering.

- To lead to a qualification conforming to the M-level (HE4) of the FHEQ.

10 Intended Learning Outcomes; Teaching and Learning Strategies and Methods; Assessment Strategies and Methods

Graduates from this Masters programme should have an extended working knowledge and appreciation of mechatronic engineering, with in-depth knowledge and skills in certain specific areas. Their skills in the application of a range of analytic and numeric tools and techniques to engineering systems should be well-developed beyond that expected at the undergraduate level, and they should have the ability and confidence to apply, and critically assess, results obtained from such methods. Graduates should be able to propose/formulate suitable strategies and practices to tackle typical, mechatronic engineering orientated problems.

A. Knowledge and Understanding

A successful student will have gained and be able to demonstrate:

A1 An advanced knowledge of a broad range of modelling methodologies, and underlying mechanical science, commonly used in the development and analysis of mechatronic engineering systems.

A2 Knowledge of fundamental design issues relevant to mechatronic engineering, and an understanding of how to formulate and analyse design solutions in various engineering contexts.

A3 Working knowledge of a range of modern mathematical methods and tools used in the development and analysis of mechatronic engineering systems.

A4 In-depth knowledge of one or more of the following (depending of selection of option modules and project area): specific engineering systems, design methods, modelling techniques, mathematical and/or numerical techniques.

A5 Knowledge of basic research and development principles and practices relevant to mainstream engineering industry.

A6 Knowledge of key professional, safety and ethical issues arising in modern engineering industry.

A7 Knowledge of time-management and work planning issues related to the organization, implementation and successful completion, including reporting, of an individual, Masters level, engineering based project.

Teaching Strategy/Methods

The main mechanism for imparting the above knowledge and understanding in A1-A6 is lectures, combined with tutorials, examples classes, activities and coursework. Design labs

and CAD sessions are used for A2, whilst microprocessor labs form part of the teaching methods for some of the numerically orientated option modules (A4). In-depth knowledge outcomes in A4 are also achieved via project work, as is outcome A7. Outcome A6 is also supported by project based experience in many cases.

Learning Strategy/Methods

Students are required to support and reinforce lecture based knowledge transfer through private study, making use of recommended texts and web-based material. Tutorials allow lecture material to be discussed and supplemented, and provide a mechanism for detailed feedback to the student on coursework. Supervised project work provides the student with the opportunity to develop knowledge and understanding in an area of interest to a greater depth, and further reinforces material from the taught component of the programme.

Assessment Strategy/Methods

Formative assessment of student progress on taught modules is affected through the use tutorial exercises and coursework in the form of written answers to set exercises and/or case-study reports. The primary, summative means of assessing knowledge and understanding is the closed book examination. The balance between coursework assessment and examination varies as appropriate to each module. In-depth learning and understanding acquired during work of the main project is assessed by dissertation. Interview of candidates by the external examiner is also used, where appropriate, to assess student learning.

B. Subject-specific/professional skills

A successful student will be able to

B1 Identify, adapt and develop models appropriate to the study of a wide-range of different mechatronic engineering type systems, processes and products.

B2 Apply standard scientific principles to develop mechatronic engineering solutions to a range of practical problems.

B3 Select and apply appropriate mathematical and/or numerical methods for analysing relevant problems, and to critically assess and interpret results obtained from these methods.

B4 Propose, formulate and present suitable design strategies and practices to tackle typical mechatronic engineering orientated problems.

B5 Undertake an independent literature review on a specialized engineering topic.

B6 Produce clear and detailed written report of engineering project work.

Teaching strategy

Skills B1-B4 are introduced, illustrated and explained in lectures and examples classes. Subsequent work in tutorials and labs reinforces these skills. More in-depth exposure to skills B1-B4 is provided during work on the main project, which is also central to the strategy for teaching B5-B6. Key transferable skills underpinning B5-B6 are introduced in the taught component of the programme, serving as preparation for project work.

Learning Strategy

Skills B1-B4 are developed through work on exercises provided in lectures, example classes, tutorials and labs. Regular student attendance and participation at all formal classes is expected and required. Acquisition of B1-B4 is also through application and extension of taught material to project work, which provides the main mechanism for developing skills B5-B6.

Assessment Strategy

Satisfactory acquisition of skills B1-B4 is formally assessed through coursework (written solutions to set problems, lab reports and mini-projects) and written examination. In-course assessed work provides an important mechanism for monitoring student development through the course. Written examinations test skill acquisition and the ability to apply such skills under time constraints. B5-B6 are assessed by project dissertation.

C Cognitive skills

The programme provides students with opportunities to develop and demonstrate skills in

C1 The interpretation and critical assessment of existing theories, models, methods and results, both qualitative and quantitative, within an engineering and physical science framework.

C2 The recognition and appreciation of problems inherent in a mechatronic engineering system or approach, and the ability to synthesis, and propose evaluation methods for, alternative solution strategies.

C3 The construction of rational argument and the logical presentation of results.

Teaching strategy

The inculcation of cognitive skills C1-C3 takes place throughout the entire degree programme, and draws on teaching, learning and assessment strategies (as employed in lectures, tutorials, labs and project work) described in A and B above. Project work provides an important mechanism not only for consolidating the technical information and learning

outcomes introduced and developed in the taught modules, but also for developing more generic, cognitive skills by drawing on the body of these experiences and learning outcomes. Supervision of project work is structured to assist students develop their learning skills.

Learning Strategy

Students are encouraged to adopt a critical and logical approach when interpreting the methods and ideas presented and discussed in the programme. Emphasis is given to the requirement of submitting work that exhibits clear and logical presentation, with rational explanations of methods employed. In this respect the planning, execution and reporting of work undertaken during the project plays and important role in the development of cognitive skills.

Assessment Strategy

Primary assessment of cognitive skills is via evaluation of student performance on submitted coursework (problem-solving exercises, mini-project and lab reports) and the final project, the later being assessed through the written dissertation together with formal feedback from the project supervisor. Written examinations for the taught modules also provide a mechanism for assessing the development of cognitive skills.

D Key (Transferable) Skills

The successful student will be able to:

D1 Communicate ideas clearly, by means of both written documentation and oral presentation.

D2 Effectively utilize modern information resources and technologies.

D3 Prioritize, organize and schedule work activities effectively.

D4 Work independently or in a team environment.

D5 Demonstrate generic problem solving skills.

Teaching strategy

Proficiency in key skills D1-D5 is addressed directly by taught material forming part of the module *Methods In Industrial Research and Development,* which is aimed at teaching generic skills and methods commonly used in industrial R&D. This material covers presentation and writing skills (D1), use of library and other information resources (D2), and work management (D3). Further, students will undertake both individual and group problem-solving activities within this module to assist in developing key skill D4-D5. Students who are not native speakers of English usually receive additional instruction related to D1 by

registering for the Language Centre module *Writing Dissertations in Science & Engineering*. In addition to the key-skill-specific taught material, students will develop these skills through participation in other aspects of the programme. In particular project based work is central in the teaching strategy for D1-D3.

Learning Strategy

Key skills D1-D5 are formally taught, and feedback on student performance assists the learning process. These skills are also required in other, subject specific modules, and active participation in these modules will further aid key skill development. Successful completion of the final project will require that a student is developing and applying these skills.

Assessment Strategy

Key-skill development is formally assessed in the module *Methods In Industrial Research and Development.* Assessment is through performance demonstrated by written work and by oral presentations. The key skills are also indirectly assessed through performance on coursework for other modules and on the final project.

11 Programme Features, Structure and Curriculum

A. Programme Features

This is a one year, full-time programme, starting in September, leading to the award of an MSc in Mechatronics. The programme consists of a taught component, which covers a range of mechatronic engineering topics, together with a major, project-based piece of work. The project work component, which represents one-third of the programme and is assessed by dissertation, usually involves laboratory based work and/or modelling and numerical studies. There is considerable scope for industrial involvement in projects.

B. Programme Structure

The taught component of the programme consists of a total of 120 credits which are studied during Semesters 1 and 2 (September-May), with 10 credits requiring a total of 100 hours of study-time. Students begin preliminary work on their individual, 60 credit project early in the first Semester. Work on the project continues throughout the year, and a project dissertation must be submitted for assessment in mid August.

C. Programme Curriculum

Compulsory Modules
Candidates shall take the following compulsory modules unless they have been studied for a previous degree programme, in which case the Degree Programme Director shall substitute appropriate modules:

Module Code	Credits	Semester	Descriptive Title
CSC310	10	2	Real-time Systems
EEE808	15	1	Distributed Control Systems
MMM804	15	2	Mechatronics
MMM805	15	1	Sensors & Actuators
MMM808	15	2	Robotics
MMM839	10	1	Methods in Industrial Research & Development
MMM899	60	1&2&3	Individual Project

Non-native speakers of English (unless exempted by the Degree Programme Director) shall normally be required to take the module:

Module Code	Credits	Semester	Descriptive Title
LCE814	10	2	Writing Dissertations in Science & Engineering

Optional Modules

Candidates will be required to select between 30 and 40 credits from the following list of modules, depending upon their background, and subject to the approval of the Degree Programme Director:

	Module Code	Credits	Semester	Descriptive Title
	CSC603	10	1	Hardware/Software Interfacing
	EEE314	10	1	High Performance Embedded Systems
	EEE813	15	2	Computer Vision & Multimedia
Either	*EEE818*	*15*	*1*	*Control Systems*
Or	*MMM807*	*15*	*1*	*Automatic Control*
	MMM806	15	1&2	Dynamics and Control
	EEE834	10	2	Microprocessor Systems
	EEE801	15	1	Digital Signal Processing
	EEE809	15	2	Digital Control
	EEE815	15	2	Optoelectronics
	EEE816	15	1	Power Electronics
	EEE819	15	2	Electrical Drives
	MMM405	10	1&2	Mechanical Power Transmissions
	MMM809	15	1&2	Design for Production
	ENM313	*5*	*2*	*Numerical Methods with Applications*
Either				
Or	*ENM319*	*5*	*1*	*Optimization*

In appropriate circumstances, the Degree Programme Director may substitute up to 20 credits of alternative relevant modules to those listed above.

See appendix I table showing relation of curriculum components to learning outcomes ABCD.

12 Criteria for Admission

Applicants for this MSc should have a good Honours level first degree in a relevant engineering discipline.

Applicants who hold non-standard qualifications, and/or have relevant experience will be considered on an individual basis.

In addition, applicants who are non-native speakers of English are required to provide evidence of English language proficiency equivalent to IELTS of 6.5 or better.

13 Support for students and their learning

- The first, induction, week of the programme offers a series of introductory lectures, meetings and visits designed to support new students. These activities include meetings with the Degree Programme Director and other School staff to discuss the programme; a guided tour of the main University (Robinson) library; and a variety of social activities arranged by the Student Union, including specific events for overseas students. Details and schedules of induction week activities are sent to students in August, prior to the start of the programme.

- Students are allocated a personal tutor whose role is to assist students on both academic and non-academic issues.

- Facilities available to students to support their learning include a range of computing services, offering technical software, email and internet access; use of the Robinson library, and electronic information resources; and the University Language Centre.

- Other University provided services supporting student welfare include the Accommodation Office; careers and counselling services; Student Progress Office; International Office; Chaplaincy; Centre for Physical Recreation and Sport. In addition, on arrival in Newcastle students are encouraged to register with the local Saville Medical Practice.

- The School provides each student with a Degree Programme Handbook, which contains essential information concerning the operation and content of the programme, together with further details of support facilities provided by the School and University, and expectations of conduct placed on students.

Services and facilities available to students include the following:

- Personal Tutor;
- Degree Programme Director;
- Student/staff ratio of 15:1
- Induction activities for Stage 1;
- Study skills instruction in Stage 1 and University Web based materials;
- Library visits and instruction;
- Degree Programme Handbook (including Degree Regulations and Module sheets);
- School Student Handbook (Web based);
- University Computing Service facilities (including extensive PC and UNIX provision, software applications, e-mail and internet access);
- University (Robinson) Library, including search facilities and inter-library loans;
- School Office;
- Extensive laboratories;
- School MSc Common Room
- University Housing Office (which makes an offer of University accommodation to each first year student);
- University Careers Service;
- University Counselling Service;
- University Language Centre;
- Students' Union services, including societies, refectories and Student Advice Centre;
- Centre for Physical Recreation and Sport;
- Student Progress Office;
- International Office;
- University Chaplaincy;
- Saville Medical Practice.

14 Methods for evaluating and improving the Quality and standard of teaching and learning.

Mechanisms for review:

- Internal review
- Annual Monitoring/Review of Taught Programmes
- Module Review (including University Questionnaire Service returns)
- Annual Review/Revision of Regulations
- HEFCE/QAA Reports
- External Examiners' Reports to VC

(Ref: FTC Minutes annually)

Committees with responsibilities for quality and standards

- University Teaching and Learning Committee
- Faculty Teaching and Learning Committee
- Faculty Management Board (for resource issues)
- Board of Studies
- School Teaching and Learning Committee
- School Staff/Student Committee
- Board of Examiners (Ref: Exam. Board Minutes file, School Office)

Mechanisms for student feedback

- University Questionnaire Service returns
- Module Questionnaires
- School Staff/Student Committee
- Student representation on Board of Studies
- University Staff/Student Committee
- Student representation on University Teaching and Learning Committee
- Personal Tutors

Staff Development activities

- All new staff complete Certificate in Learning & Teaching
- Seminars arranged by the Centre for Academic Development
- PDR
- Annual Monitoring Report prepared by Board of Studies
- Diploma in Teaching for all new staff

15 Regulation of Assessment

Assessment rules

- The Assessment rules are given in the "Taught Postgraduate Masters' Degree Entrance and Progress Regulations".
- The minimum pass mark is normally 50%.
- There is limited condonation for marks of 40-50% where the overall average mark is more than 50% and no module mark is less than 40 %

Role of the External Examiner

The External Examiners are involved in assessment of the course. Duties will normally include:

- Approval of Examination Papers
- Vetting in-course assessments and examination scripts
- Interviewing candidates prior to the Final Examination Board
- Attending the Final Board and participating in its deliberations
- Reviewing any subsequent special cases, either by correspondence or in special circumstances by subsequent visits to Newcastle.
- Returning a confidential report to the VC.

(Ref: University Regulations, PG Examination Conventions
Handbook for External Examiners of Undergraduate Examinations

16 Indicators of Quality and Standards

- Annual External Examiners' Reports (School and FTLC reviews)
- Accreditation Reports
- Annual review of student destinations
- Annual Monitoring and Review of Taught Programmes by Board of Studies and reported to FTLC
- Internal Review
- Staff / Student Committee Minutes reviewed by Board of Studies
- Annual FTC review of Faculty Stage 1 progression (by School)
- Annual BoS review of student feedback questionnaires

17 Other Sources of Information

This specification provides a concise summary of the main features of the programme and of the learning outcomes that a typical student might reasonably be expected to achieve if she/he takes full advantage of the learning opportunities provided. The accuracy of the information contained is reviewed by the University and may be checked by the Quality Assurance Agency for Higher Education.

In addition, information relating to the course is provided in:

The University Prospectus

The School Website

The University and Degree Programme Regulations

The Masters Degree Programme Handbook