UNIVERSITY OF NEWCASTLE UPON TYNE

FACULTY OF SCIENCE, AGRICULTURE & ENGINEERING

DEGREE PROGRAMME SPECIFICATION

M.Sc in Mechanical Properties of Solids

(School of Chemical Engineering & Advanced Materials)

1.	**Awarding Institution**	University of Newcastle upon Tyne
2.	**Teaching Institution**	University of Newcastle upon Tyne
3.	**Final Award**	M.Sc / Post-graduate diploma
4.	**Programme Title**	Mechanical Properties of Solids
5.	**Programme Accredited by:**	N/A
6.	**UCAS Code**	N/A
7.	**QAA Benchmarking Group(s)**	Engineering
8.	**Date of production/revision**	July 2004

9. Programme Aims:

The course aims to give engineering graduates a familiarity with current engineering materials, so that the combination of the new materials know-how with their existing engineering skills will equip them to play an informed role in the design and use of materials in the current industrial scene.

Specifically, the course aims to give advanced knowledge and subject-specific/cognitive skills in:

(a) new materials in the fields of metals, ceramics, polymers and composites,

(b) procedures for the design of components for specific applications. This includes property selection, choice of fabrication route, design of shape, use of post-treatments for property optimisation, lifetime considerations (including effects of the environment and in-service conditions) as well as density, cost and aesthetic factors.

(c) microstructure, and how it can be tailored to achieve a desired combination of mechanical properties,

(d) modern techniques for physical, chemical and microstructural analysis of engineering materials.

In addition to the above, the course aims to equip students with a range of key/transferable skills, i.e. communication – both written and oral, the ability to employ IT and library resources, the ability to work alone (managing a varying workload and meeting deadlines) and as part of a team, and the ability to problem solve in the field of engineering materials.

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

A Knowledge and understanding

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

A1 Knowledge and advanced understanding of the relevant mathematics and engineering science appropriate to current engineering materials.

A2 Knowledge of IT and relevant software packages applied to materials science, especially relating to engineering design (including relevant codes of practice).

A3. Advanced knowledge of the properties of engineering materials

A4. Where relevant, an understanding of management principles and business practices; also an awareness of requirements for safe usage and operation of materials.

Teaching Strategy (see Appendix 1 for a listing of the current Degree Programme Regulations)

A1 and A3 are imparted primarily through lectures. Safe usage of materials (A4) features frequently throughout the course, especially in the Case Study modules, and in practical aspects of project work; business aspects (A4) feature in the two business modules. A2 is covered in the stress analysis course and also in the Joining Technology, and Materials and Tribology modules.

Learning Strategy

In all taught modules, a large fraction of each module is associated with private study, which includes going through lectures notes and making reference to the additional material specified either directly by the teaching staff, or from the student's individual reading (A1-A4). The two Case Study modules specifically direct students to technical information about materials which they can assimilate and then present either as a written report or orally (A1 and A3).

Assessment strategy

Knowledge and understanding (A1-A4) are all assessed by means of unseen written examinations. In addition, some of the modules include assessed calculation sheets and others involve written coursework. The written exam papers test understanding of principles and the ability to perform calculations and understand the significance of the conclusions. The Case Study courses involve assessed oral presentations. The knowledge and understanding acquired during the project is assessed from the dissertation and in the viva examination.

B Subject –specific/professional skills

A successful student will be able to:

B1 Apply mathematical procedures and materials science principles to specific materials scenarios.

B2. Use scientific principles to model the selection, processing and product development in materials, and to be able to handle unfamiliar and problematic situations

B3 Have a familiarity with relevant analytical techniques, and their application to inform about the composition, quality and limitations of materials.

B4 Generate new ideas aimed at designing new materials for new and possible unconventional product applications.

Teaching Strategy

Understanding and experience of the practices and techniques used in materials science (B1-B3) are

taught in lectures. Materials design features in many modules, and this strongly involves all the points B2-B4. In lectures, students are also introduced to a range of analytical tools, which they become familiar with (B1) and learn the limitations of (B3)

Learning Strategy

The material presented in lectures is supported where relevant by calculation sheets and computer-based learning exercises (B1). In the Case Study courses, students see how these principles are carried out in practice, and how difficulties are overcome (B2). In their projects, students get hands-on experience of the application of all these principles (B1-B4) as applied to specific materials and also of relevant analytical techniques.

Assessment strategy
Most of these skills are tested by unseen examinations. The application of materials science principles to specific materials is studied in the Case Study modules, in which the students make oral presentations (and produce additional written reports). The project dissertation and viva also indicate how students have applied these skills to the specific subject of study of their project.

C Cognitive skills
A successful student will have developed:

C1 Skill and experience in the use of mathematical and engineering science procedures as applied to materials.

C2 Skill in using analytical methods and IT tools, and an awareness of their limitations

C3 A skill in testing out design ideas through laboratory work, using relevant measuring equipment and in so doing developing an ability to critically assess the reliability of results.

C4. An ability to research information and evaluate/apply this to a specific materials application.

C5. The ability to manage a project, including the monitoring and managing of a personal programme of work.

Teaching Strategy

Students develop all the above cognitive skills (C1-C5) whilst carrying out their projects. Here they can take the knowledge and understanding acquired in the lectures, coupled with the ability to apply these in the materials field as outlined in B above. The teaching process is assisted by the students in most cases being linked up with on-going research projects in the School.

Learning Strategy

In the projects, students collate/examine data relating to the behaviour of a particular group of materials. Analytical methods are involved (C2) and these are used to test out ideas (C3), which requires them to process results (C4), and then manage the overall results in an output in the form of a dissertation (C5). The presence of researchers in the materials group familiar with the procedure allows the student to learn these procedures very quickly and effectively.

Assessment strategy

Students produce a 50-60 page dissertation summarising their project work, which is assessed by members of staff, and which they defend by viva voce examination. In many courses the subject of the project will have been familiar to the student from lectures, and the carrying out of the project will serve to familiarise many topics which come up in the unseen examinations.

D Key (transferable) skills

A successful student will be able to:

D1 Communicate clearly and effectively on materials topics both in written reports and oral presentations.

D2 Solve problems, including the ability to be creative and innovative, and be able to find the most appropriate solution in the case of contradictory and often incomplete data.

D3 Use IT resources and integrate presentational techniques for maximum impact

D4 Use library facilities and be able to employ these and other reference materials to research particular topics in the materials field.

D5 Organise a workload of varying tasks and meet imposed deadlines.

Teaching Strategy

During induction week, students are informed about library, IT and computing facilities (D3), since use of these is involved in many items of assessed work. Throughout the course, the selection and use of materials is often presented in the context of solving problems (D2); the tribology and joining technology courses particularly major on this, and reasons for the use of particular materials are general backed up by appropriate mathematical and scientific arguments. The two Case Study courses give students experience in D1 and D4. Both the Case Study courses and the Project give students experience in planning tasks and meeting deadlines (D5).

Learning Strategy

Students are given practice throughout the year in report writing, giving talks, and then in their project, collecting data and converting this into a well-structured report (D1, D3). The project also gives opportunities for exploring all aspects of D2. Their experience of rapid assimilation of information followed by presentation (as a short talk or report) in the Case Study modules aims to simulate the real life situation which often arises in industry (D1, D4). D5 is most effectively communicated by “doing”, and the project provides the perfect opportunity for gaining practice in this area.

Assessment strategy

Key skills are not examined by a formal examination procedure, but students’ abilities in oral presentation (including use of overheads/power point and handling discussion) is assessed in the Case Study courses (D1, D3); their report writing is assessed by in-course assessments in many of the modules. Producing the final project dissertation will develop both D5 and D4, and will give real experience of putting into practice what has been learnt about D2 from the taught courses. The ability of students to explain themselves and argue a point of view is tested in the viva voce examination.

11 Programme Features, Structure and Curriculum

A Programme Features (see module lists given in the Degree Programme Regulations in Appendix 1).

The course is a 1-year, full-time programme of study. It consists of 120 credits of taught components, presented in Semesters 1 and 2 of the Academic Year, followed by a 60 credit project, notionally attributed to the summer period, but in practice a considerable proportion of the work needs to be undertaken before the June examinations. The project is submitted by mid-August, to allow time for the Examination Board meeting in late August/early September. The taught components of the M.Sc consist of 100 credits of compulsory material plus 20 credits which students can select from three 10 credit modules. Most modules are taught at the rate of one or two lectures per week throughout the year; the Materials & Tribology module is taught entirely in Semester 1 and Joining Technology entirely in Semester 2. Students choose project topics from a list provided by the Degree Programme Director at around Christmas time. It is possible for students to suggest their own topics of study provided these are approved by the Degree Programme Director. Generally, in projects, students work alongside post-graduate or post-doctoral researchers, and attend supervision meetings with their supervisor at regular intervals. Occasionally projects involve local industry, in which case the student will visit the industrial company, and a representative of the company will attend project supervision meetings.

B **Programme Curriculum and Structure**

Current regulations for the M.Sc in Mechanical Properties of Solids are listed in Appendix 1. The taught components consist of two main materials modules (Advanced Materials and Processes, and Integrated Design), which define the main thrust of the course and are taught in the form of Case Studies. The remaining compulsory modules provide supporting material for these (Materials & Tribology; Reliability and Lifetime Prediction; Joining Technology; Stress analysis; Manufacturing Technology). A mapping of Intended Learning Outcomes versus modules is shown in the table below.

Module	Cr	St	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	C5	D1	D2	D3	D4	D5
BUS310	10	cp				√										√				√
CPE404	15	cp			√			√	√	√				√		√		√	√	√
CPE405	15	cp		√	√		√	√	√	√				√		√		√	√	√
CPE301	15	cp	√	√	√		√	√	√	√	√	√					√			
CPE303	10	cp	√	√	√		√	√	√		√						√			
CPE300	10	cp	√		√				√		√						√			
CPE401	15	cp	√		√	√	√	√	√	√	√		√				√			
MMM301	15	cp	√	√			√		√		√	√					√			
MMM452/62	15	cp	√	√	√	√	√	√	√	√	√	√		√			√			
CPE818	10	cp				√										√				
PROJECT	60	cp				√	√	√	√	√	√	(√)	√	√	√	√	√	√	√	√

Cr = credit rating; St: status; cp = compulsory module

12 Criteria for Admission:

Standard entrance criteria

Applicants should have a 2nd class honours degree or better from a U.K. university, or the equivalent from an overseas institution. In exceptional cases, students with lower qualifications are considered. Students should have their first degree in an engineering or engineering-related subject, in which materials science or materials engineering has been included as a module in the first two years of the course. Candidates with first degrees in chemistry, physics or other related science subjects can also be considered.

Admissions policy

UK-based applicants who meet the entrance requirements outlined above are generally invited on receipt of the Application form to come up for interview – especially if they request this, or if there are other reasons why they wish to visit the school/university. Candidates supply names of referees, and at least one satisfactory reference is obtained. Under normal circumstances, suitably qualified applicants are always offered a place.

Overseas students (who from the largest number of applicants) are not invited for interview, and are offered a place on the course if their qualifications are equivalent to those listed above for UK students, and their level of English is consistent with the University requirements for overseas students, i.e. an IELTS score of at least 6.5 or a TOEFL score of 575 or above.

Arrangements for non-standard entrants

Any candidates in this category are considered on an individual basis.

13 Support for Students and their Learning:

Induction

The first week of the first term/semester is an Induction Week with no formal teaching. During this period all students are given detailed programme information relating to their course and the timetable of lectures/tutorials/etc. In particular all new students are given general information about the School and their course, as described in the Degree Programme Handbook. The International Office offers an additional induction programme for overseas students (see http://www.ncl.ac.uk/international/coming_to_newcastle/orientation.phtml).

Study skills support

Students will learn a range of Personal Transferable Skills, including Study Skills, as outlined in Section 10 of this Programme Specification.

Academic support

The initial point of contact for a student is with the Degree Programme Director, who acquaints the student with all matters relevant to actually starting on the course. Thereafter the DPD remains the initial point of contact for academic matters, but in cases where this route is unsuccessful, the Head of School may be consulted. Issues relating to the programme may be raised at the Staff/Student Committee, and/or at the Board of Studies, or regarding regulations at the Student Progress Office.

Pastoral support

All students are assigned a personal tutor whose responsibility is to monitor the academic performance and overall well-being of their tutees. Details of the personal tutor system can be found at http://www.ncl.ac.uk/postgraduate/support/tutor.phtml. For the present M.Sc, the DPD generally acts as the tutor for all students on the course. In addition the University offers a range of support services, including the Student Advice Centre, the University Chaplaincy, the Student Counselling Service, the

Mature Student Support Service, and a Childcare Support Officer, see http://www.ncl.ac.uk/undergraduate/support/welfare.phtml. Standards wishing to take up sporting activities are encouraged to do so by contacting the Centre for Physical Recreation and Sport.

Support for Special Needs
Support for students with special needs is provided as required and the University's Disability Support Service can be consulted where appropriate. For further details see http://www.ncl.ac.uk/undergraduate/support/disability.phtml.

Learning resources
The University's main learning resources are provided by the Robinson and Walton Libraries (for books, journals, online resources), and Information Systems and Services, which supports campus-wide computing facilities, see http://www.ncl.ac.uk/undergraduate/support/acfacilities.phtml.
All new students whose first language is not English are required to take an English Language test in the Language Centre. Where appropriate, in-sessional language training can be provided. The Language Centre houses a range of resources for learning other languages which may be particularly appropriate for those interested in Erasmus exchanges. See http://www.ncl.ac.uk/undergraduate/support/langcen.phtml.

14. **Methods for evaluating the quality and standards of teaching and learning**

Review mechanisms
The Annual Monitoring and Review (AMR) report is submitted to the Faculty teaching and learning committee summarising the year's activity and commenting on significant features and changes actioned. This will incorporate comments on Module review (which also includes a summary of students questionnaires collected during the year); based on this, Module sheets for all courses are revised to reflect changes. The External examiners report is submitted to the University following on from the Exam board meeting, and comments arising from this are fed back to the DPD, and necessary actions approved through the Board of Studies. Comments arising from the staff/student committee are also regularly considered by the Board of Studies and necessary actions taken. To facilitate this, there is post-graduate representation on both the post-graduate teaching and learning committee and also on the post-graduate Board of Studies.

Committees with responsibilities for quality and standards

The school post-graduate teaching and learning committee deals with day to day business relating to the running of the course. Issues requiring formal policy approval are fed into the post-graduate Board of Studies, which meets 3 or 4 times per year; frequently issues are brought up at this committee which have arisen from the deliberations of the staff-student committee. If any decisions placed before the board of Studies relate to resource issues, the matter is raised at the School executive committee for approval. The school post-graduate teaching committees interacts with the Faculty PG(T) committee, which can in many cases feed policy down to the school for actioning. Also, the Board of Examiners for the course, assisted by the External examiner are concerned to see that standards are maintained for the course.

Staff development activities

All new academic staff in the school are required to complete a Certificate in Learning and Teaching during the initial years of their appointment. The annual Board of Studies review of each module also brings up recommendations which are fed back to staff for generating improvements in the presentation of individual lectures courses.

15 Regulation of Assessment:

Course Requirements

Progression is subject to the University's Postgraduate Progress Regulations (http://www.ncl.ac.uk/calendar/university.regs/pgcont.html) and Postgraduate Examination Conventions (http://www.ncl.ac.uk/calendar/university.regs/pgexamconv.html). In summary, students must obtain a pass mark (>50% average) in both their taught modules and in their project. Limited compensation down to 40% is possible (provided the total credits failed is less than 40) and there are re-sit opportunities for taught modules (not more than one time per module). In the case of an inadequate dissertation, a student can be asked to either make minor corrections, or re-write a significant part of the work; alternatively, if it is considered to be not up to M.Sc standard (and the standards is registered for an M.Sc degree), the student can be awarded a diploma if his overall taught module score is in excess of 50%.

Students who obtain an overall average mark in excess of 60% can be awarded a pass with merit, and if the average mark is in excess of 70%, a pass with distinction.

Role of the External Examiner

An External Examiner, a distinguished member of the subject community, is appointed by Faculty Teaching and Learning Committee, after recommendation from the Board of Studies. The External Examiner will:

- See and approve examination papers
- Look over marked scripts and coursework
- Moderate examination and coursework marking
- Look over dissertations and confirm that the marking is satisfactory, and the standard of the work is appropriate for M.Sc level
- Carry out Viva Voce examinations if required.
- Attend the September Board of Examiners meeting
- Submit a report to the University annually, commenting on the running and the standards of the programme

16 Indicators of Quality and Standards:

Professional Accreditation Reports

Not applicable

Internal Review Reports

This programme is due for Internal Subject Review in Semester 1 of 2005-6.

Previous QAA Reports

None

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.

17 Other Sources of Information about the programme

The University Prospectus (see http://www.ncl.ac.uk/postgraduate/)

The School Prospectus (see http://www.ncl.ac.uk/ceam/postgrad/pg-teach.htm)

The University and Degree Programme Regulations (see http://www.ncl.ac.uk/calendar/pdf/uniregs.pdf and http://www.ncl.ac.uk/calendar/sae/)

The Degree Programme Handbook

The school website (see http://www.ncl.ac.uk/ceam).

Appendix 1. Degree Programme Regulations

M.Sc in Mechanical Properties of Solids

Degree Regulations 2004-5

The course is designed for students who have studied Materials Science or Materials Engineering as part of a degree course in Mechanical Engineering or a related subject, and who wish to pursue materials-related studies at a higher level. The course starts in September and finishes in mid-August the following year. Candidates will take a total of 180 credits of study, 60 in each of the two semesters, plus a project weighted at 60 credits, notionally allocated to the summer period.

Core subjects

CPE404	Advanced Materials & Processes	(15 credits)
CPE405	Integrated Design	(15 credits)

Compulsory modules

CPE301	Materials & Tribology	(15 credits)
CPE303	Reliability & Lifetime Prediction	(10 credits)
CPE401	Joining Technology	(15 credits)
MMM301	Stress analysis	(15 credits)
MMM452/462	Manufacturing Technology 4	(15 credits)

Optional modules

Students will select an additional 20 credits from:

BUS310	Technology Management & Technological Change	(10 credits)
CPE300	Corrosion & Oxidation	(10 credits)
CPE818	Business and Environmental Management	(10 credits)

Project

Students will undertake a project valued at 60 credits.