

SUBJECT REVIEW REPORT

**DEPARTMENT OF
MATERIALS ENGINEERING**



**FACULTY OF ENGINEERING
UNIVERSITY OF MORATUWA**

20th to 22nd September 2006

Review Team :

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1. SUBJECT REVIEW PROCESS

Subject review process formulated by the University Grants Commission evaluates quality of education within a specific subject or discipline. It is focused on the quality of the student learning experience and on student achievements. It has been designed to evaluate the quality of both undergraduate and postgraduate programmes offered by academic Departments of the Sri Lankan Universities.

This report describes the outcome of a review carried out to evaluate the quality of the academic programmes and related issues in the Department of Materials Engineering of the Faculty of Engineering of the University of Moratuwa. The review team consisted of Prof. L. Jayatilleke, Prof. B.S.B. Karunaratne and Prof. L.Munasinghe, and the team visited the Department of Materials Engineering during the period of three days from 20th to 22nd September 2006.

In this exercise the following aspects were examined and evaluated.

1. Curriculum Design, Content and Review
2. Teaching, Learning and Assessment Methods
3. Quality of Students, Student Progress and Achievements
4. The Extent and Use of Student Feedback
5. Postgraduate Studies
6. Peer Observations
7. Skills Development
8. Academic Guidance and Counselling

2. BRIEF HISTORY OF THE UNIVERSITY AND THE DEPARTMENT

The University of Moratuwa was established by an order under the Universities Act, No.16 of 1978, and has its origin in the Ceylon Technical College of Maradana, Colombo which was established in 1893. At present, it is considered as Sri Lanka's leading institution of higher education in technological studies.

According to Corporate Plan 2001-2005, the vision of the University is to be a centre of excellence of higher learning "with emphasis on national relevance, international recognition and creativity in Engineering, Architecture and other professional disciplines". The stated mission is to be "an internationally recognized centre of excellence in higher learning, research, consultancy and other professional activities in Engineering, Architecture and allied professional fields by creating an environment conducive to nurturing the inquiring mind and developing the skills for a diversity of challenges, and thus be a leader in contributing to sustainable scientific, technological, social and economic development of Sri Lanka." In pursuance of these the University currently has three faculties and seventeen Departments of study and the Department of Materials Engineering is the only one in Sri Lanka, which offers a Bachelors' degree course in Materials Engineering.

The Department of Materials Engineering was first established in April 1974 as the Department of Materials Science, which was a sub-Department of Faculty of Applied Science. Later in 1981, it was renamed and brought under the Faculty of Engineering, after modifying the course by adding more engineering subjects.

The vision of Department of Materials Engineering is directed towards becoming a centre of excellence in higher learning, research, industrial consultancy and other relevant activities in the field of Materials Engineering, under the categories of Ceramics, Polymers and Metals.

The mission of the Department is to create an opportunity for the undergraduates to acquire a specialized knowledge on Engineering Materials with an insight to economical and ecological utilization of materials in the engineering and allied fields and to broaden the knowledge in engineering design, management and the use of information technology to become competitive professionals.

The Department of Materials Engineering offers BSc Engineering (Honours) degree in Materials Engineering. This is a four-year degree programme consisting of four levels, Level-1 being common to all students in the Faculty. The medium of instruction of the programme is English. The annual student intake to the Faculty is about 700, and at the end of Level-1 about 30 students are admitted to the Materials Engineering stream. However the Department of Materials Engineering has the capacity to accommodate fifty students in the undergraduate programme, starting from level-2 upwards. In addition, the Department offers a Level-1 subject as a service module, which is taken up by around 700 students. The Department is responsible for the laboratory facilities, and the lectures in this module. The Department also offers service modules to the Department of Chemical and Process Engineering and the Department of Earth Resource Engineering, which are followed by about 100 students. In addition, the Department offers subject modules for the Faculty of Architecture as well.

At present there is a total of 102 undergraduates at all 3 levels, in the Department of Materials Engineering.

The Department has 4 senior lecturers, 6 lecturers and a teaching assistant. In addition, the Department takes the services of subject experts as visiting lecturers and consultants mostly from the industry. Ten permanent non-academic staff members support the academic staff. The reviewers are pleased to observe the satisfactory way in which the equipment are maintained.

Laboratory Facilities

The Department has the following six laboratories, each equipped with sufficient facilities to provide basic practical knowledge in Materials Engineering for the undergraduate students as well as to provide services to industry.

- a) Microscopy and Analytical Laboratory: This laboratory contains equipment for providing optical and electron microscopy facilities together with instruments for thermo-analytical, diffractometry and spectrometry studies.
- b) Polymer Laboratory: Instruments for measuring rheological properties, and some of the physical properties of polymers are located in this laboratory.
- c) Ceramic Laboratory: This laboratory is equipped with a pilot scale ceramic processing plant with a gas-fired kiln and facilities for chemical and physical property measurements related to ceramic science.

- d) Foundry Laboratory: Instruments to carry out standard tests on foundry sand are located here. In addition, this laboratory has facilities for salt spray corrosion testing and determination of carbon and sulphur content in steels and cast iron.
- e) Materials Testing Laboratory: Equipment for mechanical and non-destructive testing are set up in this laboratory.
- f) Heat Treatment Laboratory: This laboratory houses the furnace facilities in the Department, which are used for heat-treating of metals and ceramics. The workshop facilities of the Department too are located as a part of this laboratory.

Computing Facilities

Students are provided with computing facilities through a computer laboratory equipped with thirteen computers, each of which is provided with Internet browsing and subject module related software. These facilities are made available to students from Monday to Saturday from 8.00 a.m. to 7.30 p.m.

Classroom Facilities

The Department has the exclusive use of two air-conditioned lecture rooms equipped with multimedia facilities, having a seating capacity for 30 to 50 students. In addition, the Department uses a shared lecture room located in the same building. All laboratories are equipped with seating facilities for at least 20 students, which are used during practical class sessions.

Library Facilities

Library facilities are provided through the central library, which is housed in a modern building, and could accommodate 450 students in the reading and reference sections. The journal section includes latest information on Materials Engineering related research and development. The lending and reference sections house the textbook collection. Total number of textbooks in the library (covering all Engineering disciplines) is 75,000 and the subscribed journals are approximately 300. Database of the texts, journals and handbooks in the library can be accessed via Internet (LYBSIS computer automation package). Online journal access is also available.

Additionally the Department has an in-house collection of valuable textbooks, students' research reports, and journals related to Material Science and Engineering.

3. AIMS AND THE LEARNING OUTCOMES

The undergraduate programme in Materials Engineering is designed to cater to the national needs by providing students with a strong theoretical and practical foundation in the Materials Engineering with additional knowledge in research, management and information technology. This programme also creates opportunities for the students to learn non-technical disciplines and to enhance communication and soft skills in order to gain a fair competitive advantage in their career development.

3.1. Aims

- a) To provide an opportunity for the undergraduates to acquire a specialized knowledge in Materials Engineering with a supplementary education in engineering design, management, communication skills and information technology.
- b) To fulfil the needs of the local industrial sector by providing capable Materials Engineers with an up to date knowledge on trends and practices in Materials Engineering.
- c) To cultivate a mutually beneficial relationship with the local industrial sector.
- d) To provide a gateway for the Sri Lankan undergraduates to acquire higher learning skills and contribute to the global Materials Engineering research and development.
- e) To offer latest teaching facilities, effective teaching methods, quality monitoring and assessment mechanisms to ensure the quality of the Materials Engineering programme.

3.2. Learning Outcomes

On successful completion of the Materials Engineering degree programme the students should be able to:

- a) Understand the principles of Materials Engineering and their contextual applications in processing, research and development.
- b) Identify and work towards harnessing the available human resources, machines, materials and information towards higher productivity in either a production or research environment.
- c) Learn to recognize and appreciate opportunities and sources of knowledge in the realm of Materials Engineering.
- d) Contribute to the progress of the field of Materials Engineering through innovation, research and development.
- e) Satisfy the academic requirements for the Associate Membership of the Institute of Engineers Sri Lanka (IESL) and the Institute of Materials, Mining and Minerals, UK.

3.3. Programme Details

The B.Sc. Engineering (Honours) degree programme in the University of Moratuwa consists of four levels of learning, including a six-month industrial training period. The desired field of specialization is requested by the students at the end of the Level-1 study programme, which is granted based on their preference and merit.

Those who join the Materials Engineering discipline are required to complete three more levels of learning. The Materials Engineering programme consists of core modules that focus on fundamentals of Materials Science and Engineering and elective and optional modules on different specialisations such as ceramics, polymers, metals, wood, composites, cement and concrete.

The students in the Level-2, which is their first year in the Department of Materials Engineering, are exposed to the basic theories in Materials Science and Engineering as well as the core modules offered by the Electrical, Electronics, Mechanical and Civil Engineering Departments. At this level, they are also given a supplementary knowledge on English, Mathematics and Computer Programming.

Students in the Level-3 are taught the basics and applications of Materials Engineering, and they get the opportunity to select Polymer Engineering-related modules, which will lead them towards being awarded a minor specialization in Polymer Engineering. The selection of students into the minor specialization in Polymer Engineering too is based on their choice and merit. In addition, the Department offers modules on applied metallurgy and ceramics and provides opportunities for learning engineering design and management with a knowledge in mathematics. At this level, the students are required to undergo training in a manufacturing or an industrial research based establishment, for a period of six months to gain exposure to the industrial environment. During this period, the students' conduct and progress are monitored by the Departmental staff members.

The Level-4 study programme is aimed to provide a thorough knowledge on different areas of Materials Engineering together with an emphasis on management and quality assurance. At this level, the students are required to complete a project of their choice based on research or design, which gives the students the opportunity to assess and sharpen their skills on application of scientific methodology and the design process.

4. FINDINGS OF THR REVIEW TEAM

4.1. Curriculum Design, Content and Review

The curriculum of the Department of Materials Engineering was originally developed in 1974 in collaboration with the University of Leeds, UK. This curriculum was subsequently revised on several occasions to fulfil the needs of the local industry and to keep up with the global progress in the field of Materials Science and Engineering. In the year 2000, the current course modular system was first implemented with a comprehensive revision of the curriculum and in 2004 certain minor changes were made in order to the overcome shortcomings of the original course content.

Materials Engineering undergraduate programme conforms to the modular course structure of the Faculty of Engineering, with a minimum credit requirement of 150 for graduation, out of which, 15 credits are considered as non-GPA that are not considered in computing the Grade Point Average.

The curriculum is designed to build up the students' knowledge, thinking and learning abilities in a manner that creates subject interest with least stress of learning. Yet the curriculum is so designed that it is capable of producing complete Materials Engineers who are ready to face up to the entry-level challenges of employment.

The Level-1 module offered by the Department, introduces the subject, Engineering Materials to all undergraduates entering into the engineering discipline. This subject is offered and conducted with the view of familiarizing engineering undergraduates with the principles of Materials Science and its application.

The Level-2 study programme is intended to encourage the students to learn concepts of Materials Science and Engineering, by acquainting them with the other fundamental engineering disciplines and principles of engineering design.

In the Level-3, the students have the opportunity to study technology/engineering related modules. In addition to these modules, they can select modules on Management, Accounting

and Marketing. During the second semester, all undergraduates need to undergo the industrial training programme.

The Level-4 students are exposed to a specialized knowledge in selected disciplines of Materials Engineering, Management and Quality Assurance so that they will be equipped with the necessary basic knowledge, either for further education or employment in an executive capacity.

Throughout the last three Levels, students are provided with opportunities to take up mathematical and non-technical learning modules to sharpen their skills in problem solving. The students are also provided with support and guidance on speech, presentation of information, and the use of English language, to facilitate learning of other subjects.

The depth and breadth of the curriculum covered in the academic programme is well compatible with those of recognized universities in the world, which is justified by the fact that many of the Materials Engineering graduates have been accepted for postgraduate studies by leading universities in the world. It is also proved by the high employability of the graduates from the Department.

The Department reviews the curriculum and makes minor modifications each year. Major curriculum revisions are performed once in every four years, in synchronization with all other Departments in the Faculty.

The Departmental curriculum revision is initiated through the Department-Industry Consultation Board (DICB), where the Departmental staff and stakeholders from the local industry table and discuss the issues, pertaining to the content, scope and quality of the undergraduate programme. Prior to this meeting, the Departmental staff discusses and identifies the key issues to be addressed, with regard to the course content, conducting of course modules, teaching resources and student preferences. The student opinion on the conduct and content of the subject modules are obtained through student feedback forms. The Department also considers the views and opinion of expatriate graduates and former staff members in developing and standardizing the new course modules. The suggestions from the DICB members and other stakeholders are again discussed in the Faculty Board and Senate to assess the viability of implementation.

The Department strives to keep the staff members updated on the teaching methods and subject knowledge as much as possible. The staff members are provided with internet facilities, and are encouraged to become members of international professional institutions, through which they are expected to learn and familiarize themselves with the current trends and practices in their particular field of interest. Each academic staff member is allocated a fund of Rs.100,000 by the University, which can be renewed after a five-year period, as expenses for such training programmes. The Department also encourages its members to work on technical publications and to participate in available Continual Professional Development (CPD) programmes. Funds are available for the staff members to utilise for such purposes, which again is renewable after a five-year period. The knowledge and skills thus gained are used in updating the course content and the curriculum.

Materials Engineering curriculum has been designed to meet the requirements of the new technology based industry. Present curricula have been designed with the help of stakeholders in 2004. Reviewers while commending the approach followed by the

Department, is of the opinion that it is desirable to obtain a feedback from the employers and other stakeholders with a view to update the curriculum. It is desirable to introduce course units on environmental and ethical issues relevant to Materials Engineering.

Department of Materials Engineering has recognized the need for curriculum revision regularly and has made some effort to improve its curriculum.

As such, reviewers observe that the curriculum design content and review aspect in the Department is GOOD.

4.2. Teaching, Learning and Assessment Methods

The teaching strategy of the Department is designed according to the guidelines provided by Faculty of Engineering of University of Moratuwa.

All Departments in the Faculty follow a similar pattern in designing their curricula and a common timetable so that students are able to follow the service modules offered by other Departments who possess specialised resources in particular fields.

Most of the GPA modules offered by the Department are supplemented with practical class sessions, enabling the students to gain a clearer insight to the validity and interpretation of theories. In the latter stages of the study programme, students are given the opportunity to gain specialized knowledge through elective and optional subject modules. The students who have opted to follow the minor specialization in Polymer Engineering are required to take up subject modules on Polymer Engineering on a compulsory basis.

The field of Materials Engineering being a research-oriented discipline, the students are encouraged to follow the scientific method in conducting their experimental work in practical classes and project work. Special attention is given to the oral and written presentations of such components of modules to enhance the presentation skills of students.

The Department also strives to familiarize the students with the local industrial environment by organizing as many as fifteen factory visits during the study programme. The Industrial Training programme, which is a compulsory module for all students in Level-3 Semester 2, provides a comprehensive exposure to the industrial and/or industry-based research environment.

The notes and handouts are revised on a yearly basis taking into consideration feedback from students and from peer reviews to include new subject material to keep the course updated.

The students are always guided and encouraged to seek knowledge through references from books and Internet and to process and analyse information so that they will make self-reliant individuals, in solving matters pertaining to their career. They are also encouraged to use computers for seeking, processing and presentation of information.

The range of teaching and learning activities and assessment methods practised by the Department are appropriate to the development of necessary knowledge and skills in both theoretical and practical aspects of subject areas. This enables the graduates to meet the objectives of the Faculty of Engineering as outlined in the prospectus.

All courses are taught through a combination of lectures, practical classes and tutorials. At the beginning of each course module students are provided with a Course Outline where all information about the course module such as course contents, number of credits that can be earned, evaluation process and suggested references are given to students. The staff is encouraged to use modern educational aids. Handouts are distributed to students to provide them with an additional knowledge and support on the facts they learn in the class.

Practical classes have the primary aim of allowing students to learn experimental methods and transferable skills, and also reinforce and extend subject specific knowledge and the translation of theory into practice. Each student is given a complete handout for each practical which includes a list of apparatus, theory, diagrams of practical set up, guidelines on how to carry out the experiment, etc. During the practical sessions, the students are expected to work in groups and special emphasis is given to promote staff-student interaction. In addition students are given an opportunity to get some experience of performing computer-based practicals. At the end of the practical class each student submits an assignment or writes up to consolidate learning and to check progress. This is considered as a part of their continuous assessment.

In laboratory work it is important to provide opportunities for students to work independently, test new techniques, and practice the theories learnt in the lectures at least at the final year. It was observed that the group size performing each experiment in the laboratory was of the order of five or more. Reviewers feel that such opportunities should be made more effective by reducing the group size and promoting greater participation of students.

According to the Department, the fourth-year research project (throughout the year) and the fourth-year Industrial training (6 months) are specifically designed for improving the students' problem solving skills, and management skills. These courses not only build up students' confidence in self-learning, putting theory into practice, and the development of intellectual independence, but provide opportunity of establishing contacts with the professionals of their relevant fields. The fourth year research project also enables students to obtain experience in research and encourages initiative, self-reliance and originality. The Department at present conducts the research project in groups. The best way to provide research training at undergraduate level is, however, to assign projects individually. When handling large projects the same concept can be followed by assigning an each member of a group of students to study different aspects of the project. In such exercises it is important to assess the performance of students on an individual basis.

For each and every course module, a complete set of daily records is maintained at the Department. This helps to monitor the progress of course modules. Also, at the end of each semester, the entire set of lecture notes and practical handouts with answers and marking schemes are collected and kept in the Department.

Assessment Methods

All taught modules consist of a 30% continuous assessment component, out of which the students have to score a minimum of 12% to confirm that he/she has maintained an adequate level of understanding of the module's content. Various means are employed to perform continuous assessment, based on the nature of the subject content. They include the student's attendance accounting for one-sixth of the total allocation for the continuous assessment component and practical work assessment a mid term examination and/or written

assignments, which equally accounts for the remainder of the continuous assessment component. A student who fails to score the required minimum for the given module is considered as not being eligible to sit for the final examination. The results of continuous assessment are made available to the students at least 02 weeks prior to the final examination.

The final examination carries 70% of the total marks allocated to the module. It is in the form of a written examination, which is designed by one or more Faculty appointed examiners for each module. The examiners are responsible for designing the content and the structure of the questions. Each question paper is then submitted for moderation, together with the model answers, to a Faculty appointed module Moderator. A Moderator is required to follow the quality assurance guidelines approved by the Faculty to ensure that a proper standard is maintained in the question paper. The Examiners and Moderator will then discuss and make necessary changes and the Examiner will then submit the question paper to the Department of Examinations of the University, for printing. The Department of Examinations is responsible for conducting the examination and the examiners are responsible for evaluating of the answer scripts. Once the marking of the answer scripts of all modules is completed, the Department holds a meeting of all Examiners and Moderators in order to discuss the outcome of the examination. The final outcome of the Grades scored is then displayed to the students.

The students then have the opportunity to request a re-scrutiny of the answer scripts, within a week. Once the results are finalised they are submitted to the Department of Examinations, which organises a meeting of the Board of Examiners for the given level and a semester. This meeting is chaired by the Dean of The Faculty, and the all members present scrutinises the results for each module. Once all results are approved they will be submitted to the Senate for approval, before releasing the results to the students.

Assessment of Modules by Course Work

Certain modules offered by the Department are assessed only through coursework and viva, in which a student is required obtain at least 50% of the total marks to obtain a "pass" to complete the module

The final year research project (MT420), Industrial Visits (MT390), Engineering Design (MT195) and Communication skills (MT304) are such modules offered by the Department. The content of the continuous assessment components and the type of Continuous Assessment for each of these modules are different and is given in the respective Course Information sheets.

For the module MT390, the students are expected to compile a report on each factory visit, which describes the production and managerial strategies implemented by the factory, complete with his/her own views and observations.

Assessment of Industrial Training

The six-month industrial placement/training programme is jointly organised by the Department, and the Industrial Training Division of the Faculty. During the period of industrial training, the Departmental staff visits the students at site and evaluates the progress of their skill development, and implements any necessary corrective measures through discussion with the student and his/her employer or a representative. During training, the students are required to maintain a daily diary on their work assignments and observations. They are expected to use these data in compiling a comprehensive report on their industrial

training at the end of the training period, which is to be submitted to the Director-Undergraduate Training. At the end of the training programme the students are evaluated through a viva, in the presence of a panel comprising of the Director-Undergraduate Training, a representative from the National Apprentice and Industrial Training Authority (NAITA), a representative from the place of training and a member of staff from the Department of Materials Engineering.

Assessment of the Final Year Project

The module MT420 is conducted in both semesters and the June-term, and each student is required to select a research/design project of his/her choice, which is usually proposed by an academic staff member. A student may be allowed to perform his/her own project if an academic staff member of the Department can guarantee its quality and viability. The students are required to submit a monthly report on the progress of the project and they are also required to hold a weekly meeting with the supervisor. The final assessment of the project is based on a project report, an oral presentation and a viva. The report is allocated 50% of the total marks and the remaining marks are equally allocated for subject knowledge and presentation ability. During the oral presentation, the student is assessed on his/her knowledge and presentation skills by a panel of academic staff members. The project report is evaluated only by the supervisor.

It is noted that allocating grades (A⁺, A, A⁻, ... etc.) for the modules is done in a similar manner as in the old grading system. This is not satisfactory, and allocating grades and grade points should be accordance with the proposed UGC document on course unit evaluation.

Based on the above observations reviewers conclude that Teaching, Learning and Assessment Methods in the Department is GOOD.

4.3. Quality of Students, Student Progress and Achievements

Based on the results of GCE Advanced Level examination of those who follow the subjects Combined Mathematics, Physics, and Chemistry, the University Grants Commission selects students to the Faculties of Engineering at Moratuwa, Peradeniya and Ruhuna Universities.

Students who are selected to the Faculty of Engineering at University of Moratuwa are given the opportunity to follow an orientation programme, which familiarises the students with the study programmes and the facilities in the university. During the orientation programme, students are evaluated for their knowledge in the English language through a written test and the students who score less than 75% are required to follow a one-month intensive course in the use of the English Language. This is conducted by the English Language and Teaching Centre (ELTC), before commencing the Level-1 study programme. The subjects in the Level-1 are common to all engineering disciplines and it is aimed at bridging the knowledge gap between the curriculum of the GCE A-L and the entry competences for B.Sc. Engineering study programmes, and also expects to accustom students to the university learning environment. At the end of the second semester in Level-1, students are required to select their preferred field of specialisation, based on their academic performance.

Progress and Completion of Degree

Progress of the students is monitored by mid semester and end of semester examinations. Students are free to meet the respective lecturers to discuss their problems. Counselling

service also offers help and guidance to solve academic and personal problems of students. The Table 1 shows the performance of students during last five years.

Table 1. Completion of Degree – 2000 to 2005

Level of Achievement	Number	%
1 st Class	04	4%
2 nd Upper	12	12%
2 nd Lower	60	57%
Pass	16	15%
Incomplete	12	12%

Student Achievements

At the end of each semester, the students who obtain a GPA > 3.8 for the semester are included in the Dean's List, which is considered as a measure of student performance.

Either the D. Samson Rajapakse Gold Medal or the D. Samson Rajapakse Memorial Award will be awarded to the best Materials Engineering graduate based on the overall performance. An overall GPA of 3.8 qualifies the student for the Gold Medal but if it is 3.7 or above but below 3.8, the student will be awarded the Memorial Award.

The employment records of the graduates for the last five years are given in Table 2.

Table 2. Employment Record of Graduates (2001 to 2005)

Field of Employment	Number	Percentage
Ceramics	42	13
Polymer	56	18
Metallurgy	32	10
Academic	23	7
Overseas	71	22
Others	94	30
Total	318	100

The details of the initial salary and waiting time for the first job for the last five years are given in Table 3 and Table 4.

Table 3. Graduates' Profile, based on Graduation Year & Waiting Time for First Job

Year of Completion	Total Sample	Average Waiting Time (months)
2001/2002	19	7
2002/2003	19	9
2003/2004	24	11
2004/2005	12	9
2005/2006	26	3.3

Table 4. Graduates' Profile, based on Average Initial Salary

Indicator	Year of Completion				
	2001/02	2002/03	2003/04	2004/05	2005/06
Average initial salary (Rs)	12000	10000	12000	12000	18000

The reviewers are of the opinion that the Quality of Students, Student Progress and Achievements are SATISFACTORY.

However, the discussion with two groups of students created some doubt in the minds of the reviewers about attainment of the learning outcomes of the programme. For example students who had already completed the course showed inability to analyse simple problems encountered in day to day life related common engineering materials. Reviewers feel that remedial action need to be taken to rectify this.

4.4. Extent and Use of Student Feedback

Student feedback is sought and acted upon as part of the quality assurance procedure of the Faculty of Engineering and the university. This section describes the procedure adopted by the Department in response to the student feedback.

Student feedback is obtained by way of a feedback form and informal discussions with students, level coordinators and academic counsellors. The outcome of the direct student feedback is generally discussed with the students at a subsequent lecture and the individual lecturers discuss the feedback with the Head of the Department. Feedback obtained by other means are discussed in the Departmental staff meetings or reported to the Head of the Department for necessary action. The corrective measures to overcome any shortcomings will be implemented from the next time the module is offered.

The Department has given the responsibility to every staff member to look after the academic activities and welfare of a small group of 2-3 students from each level.

With the introduction of the semester system more freedom is given to the individual module coordinator of the subject to improve the quality of the module. Reviewers suggest that student feedback forms are properly analysed prior to discussion with the Head of the Department.

Reviewers grade this aspect as GOOD.

4.5. Postgraduate Studies

The Department offers the following postgraduate programmes, which currently include only the Research Degree Courses.

- Doctor of Philosophy (PhD) Degree by Research
- Master of Philosophy (MPhil) Degree by Research
- Master of Science (MSc) Degree with a major component of Research

These Postgraduate programmes can be followed on full-time basis or part-time basis, except for MSc by Research, which is offered as a full-time programme only.

The number of research students has been comparatively low but the Department expects to improve the number of postgraduate student enrolment by introducing new Masters and

Diploma level study programmes based on taught modules and coursework. The total number of postgraduate research students registered at present is as follows:

Ph.D. Degree (Part-Time)	01
M.Phil. Degree (Part-Time)	03
M.Phil. Degree (Full-Time)	01

The details of passed out postgraduate students are given Table 5.

Table 5. Details of Passed Out Postgraduate Students

Year of Completion	Degree	Number
2001	M.Sc.	2
2003	M.Sc.	1
2003	M.B.A. *	2
2004	M.Sc.	2
2005	M.Phil.	1
2006	M.Phil.	1

* Offered jointly with Department of Management of Technology

Administration of Postgraduate Study Programmes

The postgraduate courses are being administered by the Department and are offered depending on industrial demand and availability of staff and resources.

The Postgraduate Studies Division of the Faculty of Engineering is responsible for the promotion, monitoring and overall coordination of administrative work related to postgraduate study programmes. The Research Coordinator of the Department takes the responsibility of coordinating the matters relating to postgraduate studies with Postgraduate Studies Division and the Candidates.

The Higher Degrees Committee (HDC), which is a subcommittee of the Faculty of Engineering, reviews all postgraduate degree programmes and makes recommendations to the Faculty. Members of the HDC act as Research Coordinators for each Department in the Faculty.

The progress of each Research Degree candidate is reviewed regularly by a Progress Review Committee appointed by Faculty and Senate consisting of at least three members (Project Supervisor, Research Coordinator of the Department and a field expert nominated by the Head of the Department). Progress of each PhD and MPhil Degree candidate is reviewed every six months, while for MSc Research Degree candidates the period of progress review is four months. Progress of the candidate is classified as Very Good, Good, Satisfactory and Unsatisfactory. Research Coordinator reports the progress of the candidate through the Head of the Department to the Director-Postgraduate Studies, who obtains the recommendation of HDC and reports to the Faculty Board for approval of the results.

Funding of Postgraduate Study Programmes

Funds for research programmes are provided by various sources as follows:

- University Grant commission (UGC) provides limited funds for research to be undertaken by Senior Staff Members.

- Senate Research Committee (SRC) Grant is available for academic staff. This grant could be used to purchase consumable items as well as payments for research scholars (or registered PG students), based on an approved budget.
- Sometimes industry provides funds (partly or totally) for industry related projects.
- Other than the University Grants Commission, national level funding sources such as National Science Foundation, National Research Council, Energy Conservation Fund, etc. provide funds for research activities.
- Funds can also be obtained from foreign universities or funding agencies such as ADB, World Bank, SIDA, NORAD, IDRC, ODA, JICA, KOICA, etc. for research activities.

A part of the tuition fees charged for research degrees are allocated for the Departmental use. These funds are used by the Department towards their research expenses.

Supervision and Research Facilities

Each research candidate selects his/her supervisor and co-supervisor if necessary in the relevant area of research, in consultation with Head of the Department and respective staff members. After identification of research area, candidate has to prepare a research proposal. The main supervisor is an academic staff member of the Department while the co-supervisor may either be a member of the academic staff of the Department or the Faculty or an expert from the industry who possesses adequate academic qualifications. Supervisor(s) should spend specific minimum time duration per week on supervision depending on the degree Programme.

The HDC recommends the application of registration for a research degree only if the Head of the Department has confirmed that the facilities in the Department are adequate. This ensures each research student is given adequate research facilities to carryout the project successfully. If the project requires facilities from outside sources/institutes a letter of consent from the source should be provided with the application form.

The Department provides dedicated computing facilities for the postgraduate students. The facilities of the Departmental laboratories are always available for research projects. Recently, the Department has strengthened its laboratory facilities by acquiring number of test-rigs and instrumentation through ADB personnel development Project grants.

Though the Department expects to improve the number of postgraduate student enrolment by introducing new Masters and Diploma level study programmes based on taught modules and coursework reviewers were not presented with any evidence to this effect.

In spite of the availability of resources, the number postgraduate students enrolled at the Department is inadequate.

As such reviewers grade this aspect as SATISFACTORY.

4.6. Peer Observation

In accordance with Faculty guidelines, the Department carries out a peer observation procedure with the help of Faculty recommended Peer Observation Checklist. The points laid out in the Peer Observation Checklist are designed to lead the observer and the observed to a relevant and constructive discussion about teaching quality in the Department.

Each member of staff is grouped with other members of staff who are conversant with the same area of expertise. Staff members are then paired within the group and both observe one another's teaching. They discuss learning, teaching and assessment methods and new developments in the subject and each completes an observation report on the other.

At the end of each session, the observer is required to notify the Head of the Department that he or she has completed the observation with his or her partner and submits the observation report. This report is a joint statement compiled by the observer and the observed.

This enables the Head of the Department to monitor that all observations are taking place, while keeping the actual report confidential among the pairs of staff and the Head of the Department. The observation report is expected to be taken into account by the Head of Department in the annual staff appraisal. It is through this mechanism that staff training needs are identified and good practices shared.

Considering the above, the reviewers are of the opinion that this aspect is GOOD.

4.7. Skills Development

In keeping with the B.Sc. Engineering curriculum, the Department of Materials Engineering offers subjects for skill development of the undergraduates, from the Level-1 onwards. On completing the course the students are expected to achieve the skills as stated by the Department.

At the end of Level-1 the students are required to take up two compulsory modules in skill development where they learn the use of software in engineering drawing, and undertake an engineering design project in which they design and build a prototype of an innovative and marketable product. Evaluation of the student performance in skill development is mainly carried out in a flexible framework which ensures creativity and originality on the part of the student but within the norms of acceptance as decided by the relevant supervisors of the module. Their design skills are appreciated by the Department in the form of an award of a certificate and the university also provides the students an opportunity to develop and continue these projects throughout the university career.

The students in Level-2 are also provided with the opportunity to take on non-technical modules on subjects such as photography, public administration, art & tradition, meditation and professional communication.

The Level-3 curriculum offers a compulsory module in communication skills in which the students are taught and evaluated on linguistic presentation and reporting skills. During the second semester of Level-3, the students have to undergo an industrial training of six months duration. The students have the option to select the industrial organization in their preferred fields.

For the students undergoing training in ceramic factories, a special programme is organized which is called as Industry Placement Programme. This programme is organized by the Sri Lanka Ceramic Council with the assistance of the Competitiveness Programme of the USAID and the Department of Materials Engineering. In this programme, an intensive business communication programme is conducted prior to their placements in industry to improve the students' communication skills in English. To make the programme more effective, a training

manual was developed with extensive evaluation criteria that to be used by supervisory staff of the industrial organizations. An orientation programme is also conducted for the students and supervisory staff members of the factories to familiarize with the training manual. A two-day workshop on competence building is also designed and conducted by staff members of Materials Engineering Department. During the training period staff members of Materials Engineering Department and officers at TCP of USAID visit these industrial organizations to assess the progress of the students. This programme is already successfully conducted for three years and is expected to extend to the other specializations of the Department of Materials Engineering, in the future.

During the period of industrial training, the Departmental staff visit the students at site and evaluates the progress of their skill development, and implements any necessary corrective measures through discussion with the student and his/her employer or a representative. During training, the students are required to maintain a daily diary on their work assignments and observations. They are expected to use these data in compiling a comprehensive report on their industrial training at the end of the training period, which is to be submitted to the Director-Undergraduate Training. At the end of the training programme the student is evaluated through a viva.

The final year (Level-4) project, which is allocated eight credits (Ten credits in the year 2000 curriculum) out of the total requirement, is specifically aimed at developing and evaluating the research, design and presentation skills of students. Since Materials Engineering is a research-based specialisation, special attention is given to the development of research skills. The Department provides all necessary facilities for the research projects, such as laboratory, raw material, library and computing. Students are also facilitated to use additional laboratory facilities from other universities and research institutes such as Rubber Research Institute, the Industrial Technology Institute (ITI) and the Industrial Development Board (IDB). The Department also arranges the final-year students to make use of the library facilities at ITI and the IDB.

The IT skills of the students are improved through course modules, and other academic assignments such as Computer Aided Design (CAD) projects, and report-writing assignments.

The students also have the opportunity to enrol for English courses conducted by the English Language Teaching Centre (ELTC) of the Faculty, to improve their English and communication skills

A considerable portion of the development in management, communication and soft skills of the students is acquired in the period of industrial training, which is jointly organised by the Industrial Training Division and the Department.

Management skills are also improved through taught modules such as MN305, MN402, MN404, MN413 and MN407.

In view of the above activities, skills development aspect is graded GOOD.

4.8. Academic Guidance and Counselling

The Department pays special attention to academic guidance and counselling for each level, a staff member is appointed as an academic advisor, whose main duty is to assist the students in selecting the subject modules for the particular level of study, based on the student's interest and ability.

A Level Coordinator is appointed for each level, by the Dean-Faculty of Engineering on the nomination of Head of the Department. The Level Coordinator handles the coordination of information between the Department and the Undergraduate Studies Division. The level coordinator:

- Informs the relevant academic advisors and the students regarding the modules offered in a semester, registration schedule and other deadlines.
- Monitors the student registration according to the requirements of the Department.
- Obtains mark sheets after the final examination and organizes the Departmental meeting according to the examination schedule in consultation with the Head of Department.
- Coordinates submission of marks to the examinations division on time, after re-scrutiny.
- Represents the Department at the Board of Examiners' meeting for the Semester with all details in case of doubt.

From Level-2 onwards, each student is assigned to a staff member, whose responsibility is to monitor his/her progress during the study period and help out on academic and personal matters whenever it seem possible. Each staff member will be in charge of a group of 10 to 12 students.

The activities organized by the Faculty and the career guidance unit help students to adjust to the university and its surroundings.

Students who need special guidance on personal problems are encouraged to meet senior student counsellors who may direct them to other professionals depending on the need.

As such the Academic Guidance and Counselling of the Department is GOOD.

5. CONCLUSIONS

Curriculum Design, Content and Review:

Strengths/Good Practices: Incorporation of ideas from a broad base of stakeholders.

Weaknesses: Mismatch with stated learning outcomes in the self-evaluation report.

Teaching, Learning and Assessment Methods:

Strengths/Good Practices: Readiness to improve and to accept new ideas.

Weaknesses: Not using students' feedback effectively through analysis of returns and quantifying.

Quality of Students, including Student Progress and Achievements:

Strengths/Good Practices: Students have a positive attitude towards Materials Science programme.

Weaknesses: Staff members perceive students as "weak" compared to the students in other engineering streams. The Department has not marketed the subject properly to encourage the students.

Extent and use of Student Feedback, Qualitative and Quantitative:

Strengths/Good Practices: Students' feedback is collected on forms given by the Department.

Weaknesses: Feedback forms have not been subject to processing and analysis.

Postgraduate Studies:

Strengths/Good Practices: Genuine interest in promoting postgraduate studies and research.

Weaknesses: Deficiency in guidance and supervision.

Peer Observation:

Strengths/Good Practices: Peer observation is being practiced with much enthusiasm.

Weaknesses: Results not used consistently to improve teacher performance.

Skills Development:

Strengths/Good Practices: Strong positive attitude towards improving the quality of students.

Weaknesses: However the expected results are not encouraging.

Academic Guidance and Counselling:

Strengths/Good Practices: Counsellors appear to have been trained and have positive attitudes.

Weaknesses: Attention to student needs is deficient as reflected by the physical environment and life-support facilities.

Based on the observations made during the visit by the review team and discussed above, the eight aspects were judged as follows:

Aspect Reviewed	Judgment Given
Curriculum Design, Content and Review	Good
Teaching, Learning and Assessment Methods	Good
Quality of Students including Student Progress and Achievements	Satisfactory
Extent and Use of Student Feedback	Good
Postgraduate Studies	Satisfactory
Peer Observation	Good
Skills Development	Good
Academic Guidance and Counselling	Good

6. RECOMMENDATIONS

Based on observations during this review we wish to make the following recommendations.

1. Reviewers are happy to see that the academic and technical staff members of the Department maintain a cordial relationship and are enthusiastic in developing the

Department. The technical staff also showed their concern about the progress of the students and their readiness to help the students. However, in order to improve the overall academic standards of the Department we recommend the members of the Department to upgrade their knowledge in Science and Technology of Materials as this subject is expanding rapidly with the developments of new technologies.

2. We discovered that students do not have sufficient analytical skills and exploratory thinking to deal with problems related to materials. Therefore it is necessary to adhere to an approach, which motivate and guides students to developing such skills. It is also suggested to introduce new methods of teaching and innovative practices such as e-based communication.
3. Reviewers noted that students are not provided with formal tutorial sheets and formal discussion classes are not held. These are important to reinforce the theoretical knowledge and also to contribute to the teaching and learning.
4. We observed that group size per laboratory experiment is too large. In laboratory work it is important to provide opportunities for students to work independently, test new techniques, and practice the theories learnt in the lectures. Reviewers feel that such opportunities should be provided by reducing the group size and promoting greater participation of students.
5. The staff should be encouraged and supported to develop new equipment/machines using the resources available within the Faculty.
6. Those following postgraduate programmes by research need to create new knowledge by way of original work. Though most postgraduate candidates did such work some research lacked originality and currency.
7. There is a general lack of awareness of the importance and future prospects of the B.Sc. Engineering programme offered by the Department, among the Level-1 students as well as the prospective applicants to the University. It is therefore important to take effective measures with the help of Materials Engineering Students Society.
8. The present computer facilities available at the Department seem to be inadequate. It is therefore recommended to upgrade and enhance the computer facilities.
9. Reviewers would like to stress the need to expand research activities by the senior staff as it will not only improve their career development, but also helps to find solutions to problems faced by the country. As a first step in this direction, we would urge the senior staff to get involved in the research projects that are being done by their younger colleagues and transform them to strong research programmes.
10. There seems to be some obstacles for sharing the expensive equipment among the Departments. Measures need to be taken at Faculty/ University level to eliminate such obstacles. Collaboration with other Departments, Units, etc. for enhancing the effectiveness of the academic programmes is strongly recommended.

7. ANNEXES

7.1. AGENDA OF THE REVIEW VISIT

Day prior to the Review

7.30 p.m. - Private meeting of the Reviewers

DAY 1 (20-09-2006)

09.00 - 09.30 am - Welcome Meeting with the Dean and Head of Department
09.30 - 10.00 am - Discuss the Agenda of the Review
10.00 - 10.30 am - Tea Break
10.30 - 11.30 am - Department Presentation on the Self Evaluation Report
11.30 - 12.30 pm - Discussion
12.30 - 01.30 pm - Lunch Break
01.30 - 02.30 pm - Laboratory class 1 MT 405
02.30 - 03.30 pm - Observing Department's other facilities
03.30 - 04.30 pm - Observe Documents
04.30 - 05.30 pm - Meeting with the Academic Staff
05.30 - 06.00 pm - Brief meeting of Reviewers

DAY 2 (21-09-2006)

09.00 - 10.00 am - Observe Teaching a Class 1 - MT 207
10.00 - 11.00 am - Meeting with Technical & Non-Academic Staff
11.00 - 12.00 noon - Meeting with students
12.00 - 12.30 pm - Meeting with Postgraduate students
12.30 - 01.15 pm - Lunch Break
01.15 - 02.00 pm - Observe Teaching a Class 2 - MT 431
02.00 - 04.00 pm - Final year Research Projects
04.00 - 04.30 pm - Brief meeting of Reviewers

DAY 3 (22-09-2006)

09.00 - 10.00 am - Observe Teaching a Class 3 - MT 402
10.00 - 10.30 am - Academic Guidance and Counselling Core Aspect Meeting
10.30 - 11.00 am - Reviewers Private Discussion (**Working tea**)
11.00 - 12.00 noon - Meeting with Head & Staff for Reporting
12.00 - 01.00 pm - Lunch Break
01.00 - 05.00 pm - Report Writing

7.2. PERSONS MET

Academic staff members

Senior Lecturers

Jayaratna, M.

Gunapala, P. Y.

Munasinghe, N.

Adikary, S. U.

Lecturers:

Weragoda, V. S. C.

Guluwita, S. P.

De Silva K. S. B. N.

Samarasekara A. M. P. B.

Sivahar V.

Engineering Teaching Assistant

Mendis, T. D.

Non Academic Staff

Technical Officers

Chandrapala H. A. S.

Karunathillake R

Karunaratne S. D

Ranasinghe D. F

Swaris P

Laboratory Attendants

Bandusena K. D.

Abeyrathene W. P. W

Punchibanda S. M.

Marasinghe M. A. P

Labourer

Chandrakumara

Level-2 and Level-4 students

Postgraduate students

Final year research students

Academic Advisors, Level Coordinators and Student Counsellor

7.3. PLACES VISITED

Microscopy and Analytical Laboratory

Polymer Laboratory

Materials Testing Laboratory

Ceramic Laboratory

Foundry Laboratory
Heat Treatment Laboratory
Computer Laboratory

Teaching Classes observed

1. Metal Forming and Machining - MT 207 (Dr. N. Munasinghe)
2. Composites – MT 431 (Mr. V. Sivahar)
3. Total Quality Management – MT 402 (Mr. T. G. G. Dharmawardana)

Laboratory Class observed

Materials Laboratory – MT 405

7.4. SUPPORTING DOCUMENTS

1. Curriculum Design, Content & Review

Minutes of Department
Department Industry Consultative Meetings
Students Hand Book

2. Teaching, Learning & Assessment Methods

Time Tables

- (Level-1 – Semester 01 & 02)
- (Level-2 – Semester 01 & 02)
- (Level-3 – Semester 01 & 02)
- (Level-4 – Semester 01 & 02)

Types of Assignments

Lecture notes

- (Level-1 – Semester 01 & 02)
- (Level-2 – Semester 01 & 02)
- (Level-3 – Semester 01 & 02)
- (Level-4 – Semester 01 & 02)

Laboratory works

- (Level-1 – Semester 01 & 02)
- (Level-2 – Semester 01 & 02)
- (Level-3 – Semester 01 & 02)
- (Level-4 – Semester 01 & 02)

Examination moderations (Level-2 – Semester 01 & Level-3 – Semester 01)

External Examiners Reports

Performance Criteria

3. Quality of Students including Student Progress & Achievements

Students A-L Aggregates / Z score

Place of Employment, type of job and Initial Salary

Student's profile by gender (Academic year 1999/2000 to 2005/2006).

Student's profile based on GPA & Academic Standing

Student's profile by province of origin (Academic year 1999/2000 to 2005/2006).

Student's profile by waiting time for first job.

4. The Extent & use of Student Feed Back, Qualitative & Quantitative

Student feedback forms

Dr. S.U. Adikary
Dr. M. Jayaratna
Dr. N. Munasingha
Dr. P.Y. Gunapala
Mr. V. Sivahar
Mrs. K.S.B. de Silva
Mr. B. Samarasekara
Mr. V.S.C. Weragoda
Mr. B.P.S. Peiris
Mr. T.D. Mendis
Mr. S.P.Guluwita

5. Post-Graduate Studies

Post-graduate details

6. Peer Observation

Peer observation forms

Examination moderations (Level-2 – Semester 01 & Level-3 – Semester 01)

Moderator's Guide Lines

7. Skills Development

Industrial placement programme

Skills Development

8. Academic Guidance & Counselling

Academic Guidelines & Counselling

Quality Assurance Practices

List of Examiners & Moderators

**7.5. RESEARCH PROJECTS (MT 420) -INSTRUCTIONS TO THE STUDENTS,
SUPERVISORS AND ACADEMIC STAFF**

1. The students in consultation with staff members and the coordinator will decide the topics for the project during the second week of their Level-4 – Semester 1 and the students are required to do a thorough literature survey on the topic given. There will be a maximum of two (02) students in a group per project.
2. By the end of the semester 1, the students are expected to submit a report [known as 'Preliminary Report'] which should include the literature survey conducted and also their objectives, plan and experimental procedure (optional) of the project. The report should not be more than 10-12 pages of text.

3. After submission of the report, an oral examination (viva) will be held for each student on the project at the beginning of the second semester. The panel of examiners for the viva consists of the respective supervisor/s and the members of the academic staff of the Department.
4. By the end of the second semester the students are expected to complete their project work and submit the final report.
5. After the semester 2 examination, each student should give a 10-min. [20 min. per group] seminar presentation on their project on the dates decided by the coordinator with the consent of the head of the Department. Here again, the panel of examiners for the viva consists of the respective supervisor/s and the members of the academic staff of the Department.
6. Each group should meet their **supervisors** once a week (preferably **Thursdays, in the afternoon**) to discuss their progress on the project.
7. In addition **progress reports** should be submitted at the end of every month until the project is completed. This report may be a hand-written one. These monthly progress reports should be signed by the respective supervisor and submitted to the coordinator.
8. The final report will be corrected by the respective supervisor and will be given marks in accordance with the marking scheme given in clause 13.
9. Presentation/viva marks and the marks for the report will be given equal weightage when calculating the final marks.
10. If a mark **less than 50%** is obtained for the project, he/she is deemed to have **failed** the whole subject.
11. Ten percent (10%) of the total marks will be deducted for **late** submission of reports.
12. Marking scheme for project reports:

I.	Abstract	5%
II.	Introduction	5%
III.	Literature survey	10%
IV.	Procedure	5%
V.	Results	10%
VI.	Discussion	40% [20% for analysis of the results]
VII.	Conclusions/suggestions	15%
VIII.	Format	10%
IX.	TOTAL	100%