# SUBJECT REVIEW REPORT

## DEPARTMENT OF MATHEMATICS


## *FACULTY OF ENGINEERING*
## *UNIVERSITY OF MORATUWA*

7th to 9th July 2008

**Review Team :**

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**CONTENTS**

## 1. SUBJECT REVIEW PROCESS

Subject review process involves evaluating the quality of education within a specific subject or discipline, focusing on the student learning experience and on student achievement. This subject review process evaluates the quality of the undergraduate program. It is understood that the final responsibility for quality and standards remains within the institution itself, since it alone has the powers to control and to change existing practices.

Subject review process at the Department of Mathematics of the University of Moratuwa was conducted following the guidelines provided in the Quality Assurance Handbook for Sri Lankan Universities, published by the CVCD and the University Grants Commission in July 2002. The quality of education was reviewed according to the aims and learning outcomes given in the self-evaluation report of the Department.

The following eight aspects of education were reviewed at the Departmental level:

- Curriculum design, content and review;
- Teaching, learning and assessment methods;
- Quality of students including student progress and achievements;
- Extent and use of student feedback (both qualitative and quantitative);
- Postgraduate studies;
- Peer observations;
- Skills development;
- Academic guidance and counselling.

The review team visited the department for three days from July 07$^{th}$ to July 09$^{th}$ 2008. The agenda of the three-day visit was discussed with the Head of the Department and amended to suit the ground realities (see Annexure 1). The information related to the above eight aspects were collected by:

- Discussions with the Dean, Head of the Department, members of the academic and non-academic staff (see Annexure 2 for List of persons that attended the meetings) and undergraduate students and general undergraduates.
- Peer observation of the teaching process (one lectures and one practical session were observed – see Annexure 3)
- Observation of the facilities at the Department / Faculty / University (see Annexure 4) and
- Examination of the documents provided by the Department.

Each of the eight aspects was judged as good/satisfactory/unsatisfactory, noting the strengths, good practices and weaknesses. Having considered the individual category judgments, an overall judgment is reported at the end of this report on the following scale: confidence/limited confidence/no confidence; in the academic program.

## 2. BRIEF HISTORY OF THE UNIVERSITY, FACULTY AND THE DEPARTMENT

The Department of Mathematics originated when the Institute of Practical Technology was founded in 1960. Initially, the main function of the Department was to provide the necessary mathematical background for the technical personnel of sub-professional grades, who were

following various full-time and part-time courses offered by the Institute. As a result of the upgrading of specialized education and training in engineering studies, the Institute was named as the Ceylon College of Technology in 1966. A small number of local lecturers assisted by a few expatriate UNESCO staff conducted the mathematics courses. In 1972, the Ceylon College of Technology attained University status and was named as the Katubedda Campus of the University of Moratuwa. Mathematics Department then became a service department of the University, offering mathematical support to the Faculty of Engineering to conduct its B.Sc. engineering degree program. The contents of the mathematics courses offered during these periods were continuously upgraded taking into consideration the needs of the various departments offering technical subjects in various engineering disciplines. This led to the formation of a syllabus covering a wide range of mathematical subjects like Calculus, Differential Equations, Numerical Analysis, Applied Statistics, Linear Algebra and Operational Research**.** The Department also conducted mathematics courses for the National Diploma in Technology program. At that time the University was following the British system, in which all engineering students had to follow a set of common and compulsory courses in Mathematics during their first three years. The courses extended over a period of an academic year consisting of three terms of ten weeks each. Examinations were held at the end of the year. In the year 2000, the university adopted the course unit system, in which students had greater flexibility in choosing their courses. Courses were redesigned to form smaller 'modules', extending over a period of a semester of 14-15 weeks. Examinations were held at the end of each semester. Almost at the same time, the Department commenced a Post-graduate Diploma/M.Sc. Degree program on operational Research. In addition to their teaching responsibilities within the University, the staff members also have assisted many other National Institutions such as Open University of Sri Lanka, University of Colombo, University of Ruhuna, Sir John Kotelawala Defence Academy and the Institution of Engineers, Sri Lanka. Today the Department of Mathematics has grown up to be a fully-fledged academic department of the University.

## 3. AIMS AND LEARNING OUTCOMES

### 3.1 Aims

***Vision***

The vision of the Department of Mathematics is to be a nationally recognized centre of excellence in teaching and research in Mathematics.

***Mission***

Plan, draw-up, and deliver undergraduate mathematics courses that are relevant to various engineering disciplines taught in our university.

Conduct postgraduate degree programs of mathematical orientation that would support the professional development of graduates.

Continuously monitor and revise the curriculum, subject content and mode of delivery of both undergraduate and graduate courses to be in line with the changing patterns of national needs, international standards and advancements in instructional technology.

***Objectives***

As a service department in the Engineering Faculty, our main objectives are to be supportive to the broader objectives of the University, Faculty and other main Departments of various

engineering discipline towards producing world class engineers with superior knowledge, skills and attitude. We shall endeavour to provide our students a Mathematics education that will serve as a foundation for life long learning of Science, Engineering and Mathematics.

### 3.2 Learning Outcomes

Our curricula and the course contents are designed with broader objective of helping students to develop their **knowledge**

to understand and explain phenomena related to our physical or social environments through Mathematical Modelling

to analyse Mathematical Models using logical reasoning and mathematical methods

their **skills**

to solve various types of problems that may arise in engineering, using the mathematical techniques and modern computational technology.

and their **attitude**

to appreciate mathematics as an intellectual endeavour in its own right.

to apply the knowledge and skills gained for the development of the nation and benefit to mankind.

## 4. FINDINGS OF THE REVIEW TEAM

### 4.1 Curriculum Design, Content and Review

***Strengths***

- Department serves students of all other main departments by conducting lectures and tutorials in Mathematics courses.
- Department is catering to largest number of students in the university.
- It was observed by the Review Team that courses in level I are designed to cover most of fundamentals and essentials to students of any engineering discipline. The students are given a comprehensive knowledge in mathematics in level II, III and application oriented courses in level IV so that they have a good mathematical background, useful in the study of engineering and its applications, in their future careers.
- Making teaching and learning mathematics using MATLAB as a pedagogical tool.

### 4.2 Teaching, Learning and Assessment Methods

***Strengths***

- Printed lecture notes are provided well in advance to the students.
- At least half of the lecturers use multimedia equipments during lectures.
- Some lecturers give quizzes or practicals of short duration during classes.
- Standard assessment methods such as assignments and quizzes, mid and end semester examinations are used by the department for assessing the performance of the students.
- Students are happy with the way the department normally handles the mid-semester examination. It was learnt that students receive both marks and answer scripts to check their mistakes and those question papers are discussed in the lecture. The review team

admires the dedication of the staff members for undertaking the burden of conducting mid-semester examination, which involves setting papers as well as evaluation.

- Students are allowed to appeal for re-correction.
- The review team also have a high regard for the transparency of the evaluation process of student's performance.

***Weaknesses***

- Students complained that they have been compelled to learn some courses (for example Real Analysis) or some parts of some courses which were not useful to some fields of engineering (according to their understanding).

**4.3 Quality of Students, including Student Progress and Achievement**

***Strengths***

- Good results at A/L examination and High demand for UOM.
- Acceptable passing rate of mathematics course units

**4.4 Extent and Use of Student Feedback**

***Strengths***

- A formal feedback process exists.
- Every lecturer obtains feedback from at least one of his/her classes.
- Individual lecturer gives a summary of feedbacks that he/she gets with a list of follow-up actions to the head of the department.
- It has been decided to obtain student feedback in this manner for every course module taught by a lecturer.

***Weaknesses***

- The review team observed that two different forms of questionnaire had been used to get student feedback.
- From the discussions with students it was revealed that some students have a feeling that some suggestions made by them have not been given enough consideration. For example, students feel that different fields of engineering needs different special topics in Mathematics whereas some of the topics covered presently (for example, Real Analysis) are not useful to some fields of engineering. The review team understands that there is a practical difficulty to offer tailor made courses for different fields of Engineering due to shortage of academic staff.

**4.5 Postgraduate Studies**

***Strengths***

- A well established Postgraduate program in Operational Research and a newly started Postgraduate program in Financial Mathematics exist.
- Well prepared set of guidelines, rules and regulations are in place.
- Usually completes the program without taking too much time than the stipulated 2 year period.
- Passing rate is approximately 2/3.

- One Ph.D. candidate is supervised by a senior staff member.
- Results of exams are released within a reasonable period of time
- Students are satisfied about computing facilities. (Discussion with 2 OR 4 financial math's postgraduate students, and 1 PhD student). Operations research students are satisfied about library facilities as well.
- Although academic staff experience a heavy work load of teaching, some of them continue their research and publish papers.

***Weaknesses***

- According to some students, lecturers sometimes change due dates and exam dates. This causes difficulties to some students who are working.
- Financial Mathematics students are not satisfied with library facilities (not enough books)
- Students felt that more elective subjects such as corporate finance related to industry are required.

**4.6 Peer Observation**

***Strengths***

- A formal feedback process exists from 2008.
- Some of lectures have participated in the process. All of them have used the standard questionnaire provided by the Quality Assurance Cell.
- It has been decided to carry out peer observation on a regular basis in future.
- A formal process of moderating question papers exist.

***Weaknesses***

- Some lectures have not participated in peer observation process yet.
- By examining the completed feedback forms used in peer observations, the review team felt that peer observation had not been taken seriously enough. Perhaps, this is due to the newness of the process to the staff. For example, the sample forms that were provided to the review team had all 'goods' and no suggestions to improve.

**4.7. Skills Development**

***Strengths***

- Newly introduced Communication Skills Development(CSD) programme is an important initiative that aims to improve the communication skills of the undergraduate students.
- The reviewers found that the department has identified the significance of including practical skills of using mathematical software tools and has included them in the curriculum. Some tools are used in elective subjects while others are introduced at first year.
- It was observed that the department has taken the initiative of encouraging students to take part in the events that enhances inter-cultural and social harmony via events such as 'Bhakthi Gee" and "Christmas Carols". It is commendable that the department has taken the lead in encouraging the students through its Classical Music Society.

- It is commendable that the department encourages the students to take part in the competitions such as “Statistics Competitions” organised at national level. The students have won several awards in such competitions.
- It was noted that the Mathematics society has plans for conducting community out reach projects that involves assisting laymen who has skill and special interest in Mathematics.

***Weaknesses***

- The students felt that there is a need for better coordination for searching for national and international student competitions and making students aware about such events. However, the students appreciated the staff's efforts in directing the students for competitions such as statistics competitions.

### 4.8. Academic Guidance and Counselling

***Strengths***

- It was observed that the department of Mathematics actively engage in university wide counselling programmes. Two out of thirteen students counsellors and one out of 5 level-One coordinators are from the department of Mathematics. Three of the staff members serve as academic advisers among the University's seventy three academic advisers. It was noted that the staff sped a significant duration of time in advisory and counselling activities.
- The reviewers found that several levels of guidance counselling were provided to students both on a formal and informal basis. Specially, the junior staff works closely with the students in assisting them with various academic and other issues that students face. In addition, a medical officer and a professional psychological counsellor provide the necessary services to the students who need assistance.
- There is a good cordial relationship and better understanding among academic staff, non-academic staff and students. Both undergraduates and postgraduate students are happy with the services provided by the non-academic staff of the department.

***Weaknesses***

- Students were of the opinion that more services should be offered through the Career Guidance Unit. Students felt that making them aware about career paths early at the university career may help them to succeed in their future.
- There was no evidence of follow-up of the progress of the students who come for advice and counselling,

## 5. CONCLUSIONS

Based on the observations made during the visit by the review team, 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 | Good |
| Extent and Use of Student Feedback, Qualitative and Quantitative | Good |
| Postgraduate Studies | Good |
| Peer Observations | Satisfactory |
| Skills Development | Good |
| Academic Guidance and Counseling | Satisfactory |

***The overall judgment is suspended***

## 6. RECOMMENDATIONS

Based on our reading of the SER, discussions with academic / non-academic staff and students and the inspection of supporting documents, we wish to make the following recommendations.

- A major handicap is the lack of academic staff and space. Considering that the Mathematics is essential to all the students in the faculty, it is strongly recommended that providing more carder positions and space to the department be a priority.
- Lecturers had used two different feed back forms (one provided by the Quality Assurance Cell and a different one). It is recommended that all lecturers use the same feedback form. Perhaps, the department should develop its own feedback form by considering the two presently used forms.
- Financial Mathematics postgraduate students would like to see more elective/optional course in their program. Perhaps this should be considered in the next revision of curriculum.
- Try to adhere to deadlines (assignments and tests) in the postgraduate programs as much as possible
- Try to make the peer review process a more constructive one: pointing out strengths and weaknesses and making suggestions to improve.
- Adequate number of copies of recommended text books especially in Financial Mathematics need to be available in the faculty library.
- Abstract courses such as Real Analysis may be taught with more examples using software packages. Foundation courses should be given in such a way that students can understand Real Analysis.
- The students felt that more practical skills of using mathematical software tools is needed.
- The students would benefit by introducing more industry related mathematics courses in to the curriculum.

**7. ANNEXES**

## Annex 1. AGENDA FOR THE VISIT

### Day 1 – Monday 07th July, 2008

| | |
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| 08.30 – 09.00 | Private Meeting of Review Panel with QAA Council Representatives |
| 09.00 – 09.30 | Discuss the Agenda for the Visit |
| 09:30 – 10:00 | Meeting with the Vice Chancellor |
| 10.00 – 10.30 | Meeting with Dean, Chairman of the Faculty QA cell and the Head of the Department of Mathematics |
| 10.30 –10.45 | Tea |
| 10.45 – 11.30 | Department Presentation on the Self Evaluation Report |
| 11.30 – 12.30 | Discussion |
| 12.30 – 13.30 | Lunch with Department staff |
| 13.30 – 14.00 | Observing Departmental facilities |
| 14.00 – 15.00 | Observing Other Facilities (Lecture Halls, Computer Lab, Library) |
| 15.00 – 15.30 | Meeting with Department Academic Staff |
| 15.30 – 16.30 | Meeting with Undergraduate Students |
| 16:30 – 17:00 | Brief Meeting of Reviewers |

### Day 2 – Tuesday 08th July, 2008

| | |
|---|---|
| 09.00 – 9.30 | Observing a lecture – Mrs. D.R.T. Jayasundara |
| 9.30 – 10:00 | Observing a Mathematics practical class (CSD program) – Dr. M.Z.M. Malhardeen |
| 10.00 – 11.00 | Observing Documents (Working Tea) |
| 11.00 – 12.00 | Meeting with Technical Staff and Non-Academic Staff |
| 12.00 – 12.30 | Meeting with Postgraduate Students |
| 12:30 – 13:30 | Lunch |
| 13.30 – 14.00 | Presentation by Academic staff – Some innovative practices in teaching – Mr. U.C. Jayatilaka |
| 14:00 – 14:30 | Presentation by Academic staff – Good practices in assessments – Mr. J.M.J.A. Cooray |
| 14.30 – 15.00 | Observing Students' presentations (Postgraduate) |
| 15:00 – 15:30 | Observation of documents (cont'd . . .) |
| 15:30 – 15:45 | Tea |
| 15.45 – 16.15 | Meeting of Reviewers |

### Day 3 – Wednesday 09th July, 2008

| | |
|---|---|
| 09.00 – 9.30 | Meeting with students of Mathematical Society/Music Society |
| 9.30 – 10.30 | Meeting with Student Counsellors and Academic Advisors/Personal Tutors |
| 10.30 – 11.00 | Reviewers Private Discussion |
| 11.00 – 12.00 | Meeting with Head and Staff for Reporting |
| 12.00 – 13.00 | Lunch |
| 13.00 – 17.00 | Report Writing |

## Annex 2. LIST OF PARTICIPANTS

**Meeting with the Vice Chancellor**

Prof. M. Ranasinghe – Vice Chancellor

Dr. M.Z.M Malhardeen - Head, Dept. of Mathematics

**Meeting with the Dean, Faculty of Engineering**

Prof. A. K.W. Jayawardane – Dean, Faculty of Engineering

Dr. M.Z.M Malhardeen - Head, Dept. of Mathematics

Dr. I.R.A. Weerasekara – Director, Quality assurance cell.

**Meeting with the members of the Academic Staff**

Dr. M.Z.M Malhardeen, Head, Dept. of Mathematics

Mr. T.M.J.A. Cooray

Mr. U.A. Senevirathne

Dr. T.S.G. Peiris

Mr. N.D.S. Narangoda

Mr. U.C. Jayatilaka

Mrs. S. Ahamed

Mrs. D.R.T. Jayasundara

Mrs. H.I.B. Soysa

**Meeting with the members of the technical staff and non-academic Staff**

Mrs. Asoka Piyaseeli

Mr. K. Somaratna

Mr. S.S.T. Fernando

Mr. U.L.B.L.L Perera

Discussions were also held with 15 undergraduate and 5 postgraduate students.

## Annex 3. OBSERVATION OF LECTURE/PRACTICAL CLASS

**8th July, 2008**

| | | |
|---|---|---|
| Lecture | – | MA 4020 – Operational Research - Mrs. D.R.T. Jayasundara |
| Practical Class | – | Mat-Lab practical class (CSD program) – Dr. M.Z.M. Malhardeen with the assistance of Mrs. D.R.T. Jayasundara and Mrs. H.I.B. Soysa |

## Annex 4. OBSERVATION OF FACILITIES

Department

Lecture Halls

Computer Lab

Library

## Annex 5. OBSERVATION OF DOCUMENTS

Cooperate Plan

Detailed Syllabi of the Course Units conducted by the Department of Mathematics

Minutes of the Departmental meetings

Performance criterion for B.Sc. Engineering degree program

Question papers, marking schemes with model answers

Research Papers and Other Publications by the Academic Staff Members of the Department

Teaching Material (lecture and practical handouts)

Students Feedback forms

Peer observation feedback forms

Faculty of Engineering Academic Policies.

Mid and End Semester Examination papers, mark sheets etc

M.Sc. dissertations

Course unit marks sheets (Results)