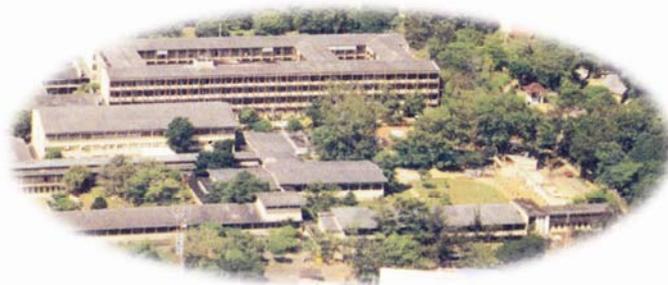


# **SUBJECT REVIEW REPORT**

DEPARTMENT OF  
EARTH RESOURCES ENGINEERING



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

06<sup>th</sup> to 08<sup>th</sup> November 2006

**Review Team :**

Prof. Athula Senaratne, University of Peradeniya

Prof. Mahinda Rupasinghe, Sabaragamuwa University of Sri Lanka

Dr. Hemantha Gunathilake, Open University of Sri Lanka

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## **1. SUBJECT REVIEW PROCESS**

The purpose of the review of the academic program of the Department of Earth Resources Engineering (DERE) of the University of Moratuwa was to evaluate the quality of education including the facilities available, student learning experience, their achievements and the marketability of the students at undergraduate and postgraduate levels.

In the process, the Review Team has studied the Self Evaluation Report (SER) submitted by the DERE and all other relevant evidence made available. The Dean of the Faculty has tabled the vital information on the general academic program of the faculty at the initiation of the review which provided a basis for the mission. The Head of the DERE has presented the academic program in greater detail with numerous supporting documents. Following the Head's presentation, an agenda for the review visit has been discussed and finalized.

The Review Team has visited all the departmental facilities including laboratories, workshops, the Main Library, sport and recreational facilities. Discussions with the Academic and Non-Academic staff were also held separately to gather information required for the review.

A lecture session and a practical class have been attended by the Review Team and at the end several students have been interviewed. A meeting with the postgraduate students was also held, and the facilities for postgraduate research have been evaluated.

The Review Team has concentrated on the following aspects of the academic program of the Department.

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

### ***Review Visit***

Dates of the Visit: 06<sup>th</sup>, 07<sup>th</sup> and 27<sup>th</sup> of November 2006

Reviewers: Prof. Atula Senaratne, Department of Geology, University of Peradeniya  
Prof. M.S. Rupasinghe, Department of Natural Resources, Sabaragamuwa University of Sri Lanka  
Dr. Hemantha Gunathilake, Department of Mechanical Engineering, Open University of Sri Lanka.

In addition to the meetings with the Dean of the Faculty, Head of the DERE, Professors, Senior Lecturers, Lecturers, Postgraduate students, Undergraduate students and the support staff, a large number of relevant documents were also subjected to serious scrutiny. Group discussions were held after individual Team members looked into the documents separately.

Some of the important documents reviewed by the Review Team are:

- Faculty Handbook 2006
- DERE Handbook
- Minutes of the Curriculum Evaluation Committee
- Minutes of Departmental meetings
- Lecture and Practical Timetable for the DERE
- Lecture Notes of some of the courses
- Laboratory Handouts given to students
- Marking Scheme of one course unit
- Grades and relevant Grade Points used in the examinations
- Syllabi of the new courses added in 2006
- Set of Course Evaluation Forms filled by the students

### ***Review Judgments and Outcomes***

The Review Team at the end of the 3-day visit made judgments on each of the eight aspects stating *good* or *satisfactory* or *unsatisfactory*.

If any review aspect is found to be unsatisfactory, action should be taken by the department within six months. If the department wishes it may request clarifications from the Review Team or make any comment on the report within a month of receiving the report. The department is required to send a report on the action taken in response to review recommendations within one year. Finally, the Review Report will be published.

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

The University of Moratuwa was established under the Universities Act, No.16 of 1978. It was evolved from the Ceylon Technical College of Maradana, Colombo, which was established in 1893.

In 1960, the Institute of Practical Technology (IPT) was founded at Katubedde with aid from the Government of Canada on a 50 acre block of land overlooking the Bolgoda Lake. The primary aim of the institute was to provide full-time courses for Technicians of sub-professional grades. It has offered full-time courses for Architects, Junior Technical Officers, Surveyors, Levelers and Draughtsman Apprentices and part-time courses for those employed in the Government and the Private sector institutions.

In 1963, the Government appointed “Commission of Inquiry on Technical Education” recommended expanding the Institute of Practical Technology to provide Professional Engineering Education and thus The Ceylon College of Technology (CCT) was begun in 1966. The IPT and the CCT were amalgamated in 1967. Within a period of 6 years of existence the CCT earned University status under the provisions of the Universities Act No.1 of 1972.

The Department was founded in 1973 with the “Houldsworth-Katubedde Link”, popularly known as “Leeds Link” to initiate graduate level education in the field of Mining and Minerals Engineering. The key areas covered by the department for graduate level courses are

Mineral Exploration, under Earth Resources Engineering Division  
Mining Engineering & Mineral Processing, under Mining and Minerals  
Engineering Division

In the year 2004, the DERE received a World Bank Grant to improve relevance and quality of undergraduate education. Under this program, the DERE has revised its undergraduate curriculum to offer the following five areas of study:

Mining & Minerals Engineering  
Remote Sensing & Geographic Information Systems  
Ocean Resources Engineering  
Gem and Jewelry  
Geo-Environmental Engineering

Each year a maximum of 50 students are selected by the University Grants Commission and admitted to the DERE. The recent statistics show that more than 50% of the graduates are employed in the fields of Mining, Mineral Processing and in Geotechnical fields. The rest are divided among the fields of Academic and Research, Management and IT.

The DERE has a well qualified and trained academic staff including

One Senior Professor  
One Professor  
Six Senior Lecturers  
Four Lecturers and several graduate instructors and technical support staff.

The senior most Professors and Senior Lecturers often work for the Government and Private Sector Institutions at high level management positions. Geological Survey and Mines Bureau and Gems and Jewelry Authority are some of those institutions. Such relationships with the industry have led to positive as well as negative impacts (discussed elsewhere) on the quality of undergraduate education and marketability of the graduates. However the newly introduced divisions such as RS & GIS, Ocean Resources Engineering and Geo-environmental Engineering require new recruits with specialized training in relevant fields.

### **3. AIMS AND LEARNING OUTCOMES**

#### **3.1. Aims**

The Vision Statement of the DERE clearly states the aims of the department. It is the only of its kind in the region which produces high quality graduates in the field of Earth Resources Engineering (ERE). The Undergraduate program in ERE has been formulated and structured to provide a strong theoretical foundation in the principles of science and engineering aspects of conventional as well as modern Mining and Minerals Engineering. The study program is also complemented with application oriented practical programs with specially designed industrial training for student's professional development. It is also expected the passing out students to develop skills to face the challenges and cater to the needs of the society.

The degree program opt to produce high quality graduates for careers in industry with due awareness of the social, economical and environmental consequences of the process industry.

In this context, the DERE aims to provide

- Degree programs of the highest quality keeping pace with technological advancements and adhering to international standards.
- A research and learning environment for students to achieve their potential and goals.
- Guidance to students to develop their cognitive, psychomotor and effective skills in Earth Resources Engineering, which would permit the students to secure employment opportunities.
- A friendly atmosphere which would promote social and cultural harmony among students and make the tenure an enjoyable, challenging and a rewarding one.
- A stimulating opportunity for students from other study programs to acquire knowledge in the field of Earth Resources Engineering.
- Rewarding and challenging prospects for the staff in their career.
- A professional and efficient administrative and managerial structure for effective teaching and learning, student assessment, review and quality assurance in study programs.

### **3.2. Learning Outcomes**

The expected outcomes of the programs conducted by the DERE are

- Firm understanding of fundamental concepts and principles of Earth Resources Engineering/Mining Engineering, Economics, Management and Mathematics.
- Knowledge and understanding of core subjects of the department i.e. Mineral Exploration, Mining Engineering and Mineral Processing including Geology, Groundwater Studies and Offshore Mineral Exploration.
- Students are also expected to be familiar with all the five study streams which are offered through introductory modules during Level 2.
- Students who follow each of the five study streams shall gain further knowledge and hands on experience through industrial training, final year project, field visits and laboratory practical in their selected areas and become competent in planning, design and execution of work related to respective fields.
- Students to develop Leadership, Organizational & Team work skills, Communication skills, Application of IT in Earth Resources Engineering

## **4. FINDINGS OF THE REVIEW TEAM**

### **4.1. Curriculum Design, Content and Review**

The University's module based semester system of 1997 was changed in the year 2000 to a Semester based one. The B.Sc. Engineering Degree consists of 7 academic semesters of 14 weeks each, a 24 week industrial training and 3 short terms of 7 weeks each, called June Terms. Under the present system the credit requirement for graduation is 150 out of which 15 are of Non-GPA (NGPA) credits. The GPA credit courses are the core courses and elective courses where the latter can be selected by the student based on his or her career aspirations, talents and preferences. As of today, the 15 NGPA credits are all compulsory and designed to impart the required transferable skills to the students.

The Degree program consists of 4 levels and spreads over a period of 4 academic years including a 6 months of industrial training.

The distribution pattern of the credits, both GPA and NGPA at all 4 levels among the departments is listed below. The table below clearly indicates that almost 100% of the GPA credits are obtained from non-ER course units. It is the opinion of the 2<sup>nd</sup>,3<sup>rd</sup> and the final year students that some of these non-relevant course units can be replaced by fundamental course units of the Level 2 to provide sufficient time space during 2<sup>nd</sup> and 3<sup>rd</sup> Levels to attend to references, extracurricular activities etc.

LEVEL	ER		Non-ER	
	GPA	NGPA	GPA	NGPA
Level 1	00	03	25	02
Level 2	27	03	19	00
Level 3	14	07	08	00
Level 4	40	00	02	00
<b>Total</b>	<b>71</b>	<b>09</b>	<b>54</b>	<b>02</b>

By engaging in the 6 month long industrial training a student can earn only 08 NGPA Credits. This may discourage active and productive participation of the students in this program. The DERE may reconsider the number of credits allocated for this program.

The Department-Industry Consultative Board has been identified as one of the many innovative components of the DERE. It is constantly in touch with the industry and undertakes consultative assignments in national level development programs. This relationship has also led to create employment for the passing out ERE students.

A recent study on the improvement of the quality of students revealed that the average GPA of the students is in rise (from 3.1 to 3.2) since the implementation the Course Unit system. The curriculum committee reviews the curriculum regularly adding and improving it to suit the requirements of the industry. The last meeting of the said committee was held on 5<sup>th</sup> April 2006.

The outcome of the final year research projects found to be commendable. However, the group approach may dilute the primary concept of the project where personal development through testing of innovative mind of individual student would be the basis of the concept. Therefore it is proposed to give each student a separate project or independent components in a group project.

In other fields of engineering, medium level professionals fill the gap of personnel requirement created by limited number of engineers passing out from universities, annually. In the filed of ERE this category is lacking. Therefore it is suggested to introduce middle level technical courses within the DERE to cater to the above requirement.

***The Curriculum Design, Content and Review methodology of the DERE is adjudged GOOD.***

## **4.2. Teaching Learning and Assessment Methods**

### ***Teaching***

The Earth Resources Engineering knowledge is conveyed to the students through lectures, field classes and field camps and by practical classes in the laboratories. A majority of lectures are conducted by the senior staff i.e. Senior Professor, Professor and Senior Lecturers. The practical and tutorial classes are conducted by junior staff members. Most of the time slides, short documentaries and multi-media facilities are used. In addition, printed lecture materials are provided to the students in all the lectures. The lectures conducted by all categories of members of the staff have been visited by the Review Team. Students expressed their satisfaction on the delivery of lectures and the lecture notes, the other materials distributed by the lecturers and the use of multimedia facilities. However, students appreciate if the senior members of the academic staff could devote more time for academic work.

### ***Learning***

In general, the laboratories in the DERE are congested due to lack of space. All the laboratories in the DERE were established two decades ago and are for a very much less number of students than today. Most of the laboratories are under rehabilitation and reconstruction. The newly introduced subjects such as GIS and Oceanography should be supported by sufficiently equipped laboratories.

The 24 hrs opened laboratories encourage students to design, making proto type models and carryout trials. This practice has been in the DERE from its inception.

The short courses conducted by the DERE have attracted the attention of the industries. Annually a large number of employees from different categories of the industry take part in these courses.

The DERE meets very often to discuss the curriculum and takes action to adjust according to the changing trends in the industry. The monthly departmental seminars help students to widen their academic horizon. The Academic and Research Award Scheme of the faculty encourage the students and the staff to enhance their research capability.

The level 4 research project provides the students an opportunity to test their skills and to show their competence. It is a group effort encompassing the whole 4<sup>th</sup> year. It helps develop team work among the students, project planning, scheduling and meeting deadlines.

The mentoring program of the faculty seem to have helped the ERE undergraduates a lot.

Currently the DERE is engaged in trouble shooting missions for the industry, specially the mining industry. The DERE should have a lathe machine centre to attend to the problems of the industry. It also needs the services of a qualified Chemist to operate the modern AAS facility which would enhance the service capacity of the DERE.

The condition in the ventilation laboratory need to be improved and separate space is needed for a map room and for a laboratory to teach mineralogy.

The supporting staff devoted to their services. The meeting held with the supporting non-academic staff (technicians, laboratory attendants, clerical staff and labourers) was very satisfactory. However, they are in the opinion that the laboratories, old and new, should have additional technicians and lab attendants.

The computer centre in the DERE has only 12 units for more than 150 students. This facility needs to be expanded with new units also with internet access and students prefer to have it opened on Saturdays too.

The Main Library is opened 7 days a week from 7.30 am to 8.00 pm. It has a very good collection of text books covering ERE subjects and latest issues of important specialized journals.

### ***Assessment***

The DERE uses a variety of assessment methods. The students are assessed by continuous assessments and end of semester assessments where 30% is allocated for the former and 70% for the latter.

The examinations are held under the course unit system. Grade Point Average (GPA) system has been adapted for evaluation. At the end of each semester students have to sit for the examinations based on the course units relevant to that semester. Papers are set and moderated by the academic staff in the DERE, appointed by the Head of the DERE. End semester examination results are evaluated and discussed at the departmental meeting and finalized results are tabled at the Faculty Board, and later confirmed by the Senate before release.

***The Review Team is in the opinion that the present status of Teaching, Learning and Assessment Methods adopted by the DERE is adjudged GOOD.***

### **4.3. Quality of Students including Student Progress and Achievements**

The DERE currently host maximum of 50 students in each batch totaling at 200 in undergraduate programs. In addition to that there are two part time certificate courses with two years of duration having 70 students enrolled in both courses.

The students who achieve Semester Grade Point Average (SGPA) of 3.8 or higher are included in the Dean's List, which is also noted in the academic transcript. The DERE contributes relatively a higher percentage to the Dean's list indicating its high academic standards. It was also noted that a large majority of the students obtain classes at the graduation.

The DERE publishes an annual journal. This journal publishes the work of the final year students in their project work. The Review Team however noted that the papers are not properly reviewed. The authors (students and their supervisors) have not followed the guidelines and not laid down to a uniform format. In some instances, important references were not listed. The Review Team expects the supervisors to pay more attention to their student research projects specifically to writing, references etc. The Review Team further proposes that DERE could commence a lecture series or even a course unit on Scientific Writing.

Although the SER of the DERE indicates that the graduates produced by the DERE have secured employment in various areas, the students complain that most of them are employed in non ERE services. In the years 2000 and 2001 more than 50% of the graduates employed by ERE employers and thereafter the employability declined, the students say.

***It is the view of the Review Team that the Quality of Students, Student Progress and Achievements of the DERE is adjudged SATISFACTORY.***

#### **4.4. The Extent and Use of Student Feedback, Qualitative and Quantitative**

Quantitative student feedback is obtained through questionnaires distributed among students in the middle of the semester and at the end of the course unit. This has been the practice since April 2005. The reviewers had the opportunity to inspect the questionnaires and the responses received and it was noticed that the comments/suggestions by the students had been grouped into five categories, namely; Very good, Good, Acceptable, Poor and Very poor. The member of the staff who receives the feedback talks to the students and makes adjustments if required.

*The Extent and Use of Student Feedback by the members of the staff of the DERE can be judged GOOD.*

#### **4.5. Postgraduate Studies**

The DERE offers a number of full-time and part-time postgraduate degrees. It has also plans to offer M.Eng. and P.G.Diploma taught courses in the fields of Remote Sensing, GIS, Mining and Minerals Engineering

The DERE currently hosts 4 full-time and 4 part-time postgraduate students. Out of these 8 postgraduate students 3 are from the academic staff of the DERE. With the facilities available at present and with the proposed development under the IRQUE grant, DERE could plan for at least 20 post graduate research students, and to attract candidates from the industry for the proposed M.Sc. taught courses.

The research facilities and arrangement for supervision are satisfactory except for the GIS and RS program. The Review Team also felt that Mineral Processing section of the DERE would be weakened as the senior most professor, who is also the only researcher in mineral processing, will be retired soon. The rate of publication from the postgraduate work cannot be considered very satisfactory. There is not sufficient interaction between the postgraduate students within the DERE and the Faculty. This could be promoted by conducting regular presentations, seminars etc.

*It is the view of the Review Team that the Postgraduate Studies of the DERE is adjudged as SATISFACTORY.*

#### **4.6. Peer Observation**

Although the DERE has recognized the importance of classroom peer observation, it has not yet been implemented. Departmental meetings are held every month to discuss various aspects of the department's on going programs. Moderation of question papers, second marking of the answer scripts by external examiners are some of the positive activities towards Peer Observation to be adopted in the near future.

*It is the view of the Review Team that the present status of the Peer Observation adopted by the members of the staff is considered SATISFACTORY.*

#### **4.7. Skills Development**

Skills development is one of most important components of the curriculum of the DERE. It has adopted various methods to improve the skills of the students through

communication and presentations, scientific investigations, report writing, and development of IT skills and through introduction of special courses. ER195-Engineering Design and ER196-Skills Development are two subjects taught in the June Term for Level 1. The DERE finds industrial training placements for each and every student for a period of 6 months during the 1<sup>st</sup> Semester of the Level 3 to help the students to enhance their skills under real life situation.

The Research Project in the Final Year plays an important role in the curriculum. It tests the skills generated by the students in application of the knowledge gained from the department.

It was also felt that the general public is not aware of the activities and the programs of the DERE of the Moratuwa University. As a result, the Cliental for an ER Engineer remains a limited one within Colombo and the Suburbs. This is among the top in the list of disadvantages faced by the ERE graduates today. It is the view of the Review Team that the Students and the DERE should organize fairs, talks, seminars, exhibitions etc to popularize the department and its academic programs.

***It is the view of the Review Team that the Skills Development programs of the DERE can be judged GOOD.***

#### **4.8 Academic Guidance and Counseling**

The Faculty stipulates that each department appoint an Academic Advisor, who is also a member of the Faculty Academic Committee. The department's Academic Advisor is officially responsible for student administration and management. The DERE has appointed Level Coordinators to assist the Academic Advisor. The Level Coordinators are responsible for administration and coordination of academic program in each Level.

The University has a full-time councilor. All the members of the academic staff act as un-official councilors. They monitor student performance throughout the academic program and provide special attention to those fall behind 2.00 Semester GPA.

The Faculty handbook and the DERE handbook are made available and are updated annually. A website provides detailed information in addition to the handbook on academic matters of the DERE. The academic staff members recommend relevant text books and other learning aids to the students. The DERE has a computer laboratory with 12 computers out of which 04 are connected to internet. The Review Team is in the opinion that the internet access should be provided to all the computers in the DERE.

Every student has the opportunity to meet the Academic Advisor, Student Counselors or any academic staff member of the department on matters related to the subject and personal problems. Academic guidance is definitely needed at the beginning of the first year, third year and when the students select their research topics. The staff student interaction and relationship are found to be satisfactory. However, it was clearly noted that the supervision in the Final Year Research Project is not sufficient. Guidance in report writing, referencing etc are to be further improved. At the final meeting with the Academic Staff of the DERE and the Review Team it was agreed to take action to improve the situation.

The mentoring program of the faculty is unique to the Moratuwa University. Level 2 students are sent to pre selected Mentors, who are leading corporate personnel in the Country. The students will have 7 weeks of interaction with their respective mentors. For

a length of 6 weeks student will attend lectures, seminars etc. delivered by some volunteering mentors.

*The Academic Guidance and Counseling practices adopted by the DERE are adjudged GOOD.*

## 5. CONCLUSIONS

Based on the observations made during the study visit by the Review Team, the eight aspects were judged as follows:

<b>Aspect</b>	<b>Judgment</b>
Curriculum Design, Content & Review	<i>Good</i>
Teaching, Learning & Assessment Methods	<i>Good</i>
Quality of Students, Student Progress and Achievements	<i>Satisfactory</i>
Extent of Use of Student Feedback	<i>Good</i>
Postgraduate Studies	<i>Satisfactory</i>
Peer Observation	<i>Satisfactory</i>
Skills Development	<i>Good</i>
Academic Guidance & Student Counseling	<i>Good</i>

*The overall judgment is suspended*

## 6. RECOMMENDATIONS

Given below are the recommendations of the Review Team. By implementing these recommendations it is expected to improve the quality and relevance of the degree programs of the DERE of the University of Moratuwa.

1. It is desirable that the DERE initiate a program to make the school children aware of the ERE programs of the University of Moratuwa.
2. It is recommended to consider replacing some of the non-ER courses in Level 1 by ER courses in order to provide more flexibility in Levels 2 and 3.
3. It is strongly recommended that the student computer facilities be improved, and internet facilities be made available to students of all the Levels. It was also noted that some of the essential software are not available in the DERE.
4. It is strongly recommended to increase teaching, learning and laboratory space within the DERE. The DERE should also have its own Mining Museum cum Mineral Collection.
5. In the opinion of the Review Team, more practical lessons in drilling, mining and blasting are required within the DERE .Currently the students get exposure only during vacation training.

6. Closer supervision is recommended in final year research projects. Regular workshops on scientific writing would improve presentation skills of the students.
7. In the opinion of the Review Team, skill and carrier development programs for supporting staff are required. The available programs could be extended to cover all categories.
8. The DERE may consider introducing taught courses leading to M.Sc. and Postgraduate Diplomas inn the near future.
9. The DERE may consider recruiting more students for postgraduate programs by research (M.Phil. and Ph.D.).
10. It is strongly recommended that the DERE train new recruits to fill the gaps about to be created by retiring senior members of the academic and support services.
11. It is recommended that the postgraduate students encouraged doing presentations. Meetings and seminars could be organized at faculty level on regular basis so that they can share ideas, knowledge etc.
12. It is strongly recommended that Peer Observation be extended for lectures and practical classes.