SUBJECT REVIEW REPORT

DEPARTMENT OF CHEMISTRY

FACULTY OF NATURAL SCIENCES
THE OPEN UNIVERSITY OF SRI LANKA

20th to 22nd September 2005

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1. SUBJECT REVIEW PROCESS

Subject review process involves evaluating the quality of education within a specific subject or discipline, focussing on the student learning experience and on student achievements. The subject review process designed by the UGC evaluates the quality of both undergraduate and taught postgraduate programmes. It is however understood that the final responsibility for quality and standards lies within the institution itself, since it alone has the powers to control and to change existing practices.

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

1. Curriculum design, content and review;
2. Teaching learning and assessment methods;
3. Quality of students including student progress and achievements;
4. Extent and use of student feedback, qualitative and quantitative;
5. Postgraduate studies;
6. Peer observations;
7. Skills development;
8. Academic guidance and counselling.

The review team visited the Department of Chemistry, Open University of Sri Lanka from 20th to 22nd September 2005. The agenda of the three-day visit is given in Annex 1. The information related to the above eight aspects were collected by having discussions with the Dean, Head of the Department, members of the academic and non-academic staff, a group of undergraduate and postgraduate students (Annex 2), by peer observation of the teaching process (Annex 3), by observing the facilities at the Department (Annex 4) and by examining the documents provided by the Department (Annex 5).

Each of the eight aspects was judged as good, satisfactory or unsatisfactory, based on the strengths, good practices and weaknesses noted. Considering the judgement of the eight aspects, an overall judgement was arrived in a three tier grading of confidence, limited confidence or no confidence.

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

The Open University of Sri Lanka (OUSL) was established in 1980 as a national university and is the only recognized university in Sri Lanka where students are able to pursue further education by distance education techniques. The degrees awarded by the OUSL are treated to be of the same level as the degrees awarded by the conventional universities in Sri Lanka.

The Central Campus and the Colombo Regional Centre are situated in Colombo with three Regional Centres in Jaffna, Kandy and Matara. OUSL also serves through 17 Study Centres distributed throughout the country.

The programs of study offered by the OUSL at present are as follows:

- Foundation courses;
- Certificate Programs;
- Diploma Programs;
- Bachelor's Degree Programs;
- Postgraduate Degree Programs;
- Continuing Education Courses;
- Stand alone Courses.

The academic departments of OUSL are grouped into four faculties: Natural Sciences, Engineering Technology, Humanities & Social Sciences and Education. The Faculty of Natural Sciences consists of six departments, namely Botany, Chemistry, Physics, Mathematics & Computer Science, Zoology, and Health Sciences.

The Department of Chemistry offers course units for three programs of study, viz. Foundation Courses in Chemistry, Advanced Certificate in Laboratory Technology and B.Sc. Degree. The Foundation courses designated as levels 1 and 2 are aimed at upgrading students to university entry requirement standard. The B. Sc. Degree program provide equivalent of a three year degree program in conventional universities (Levels 3, 4, and 5), but spread over a duration as decided by the students. The Advanced Certificate in Laboratory Technology program meets the need for development of middle level human resource to operate the laboratories. All these three programs are run in common with the Departments of Botany, Physics, Mathematics & Computer Science and Zoology. Currently two students are reading for M. Phil. Degree in the Department of Chemistry.

The permanent academic staff in the Department comprise of 3 Professors and 7 Senior Lecturers. The rest of the staff consists of 7 Educational Assistants who have been recently promoted to the grade of Probationary Lecturers, 5 Temporary Demonstrators, 2 Technical Officers, 1 Laboratory Attendant, 1 Data Entry Operator and a Labourer.

The Department is located in the Central Campus at Nawala, Colombo. It has one teaching laboratory with a capacity for 30 students and a second laboratory of similar capacity used on shared basis with other departments. The Regional Centres at Matara and Kandy possess one laboratory each. Day schools and other teaching activities are conducted using lecture theatres and classroom facilities provided by the Regional Centres. There are seven personal computers in the Department which are used on a shared basis. Students are provided with computer laboratories at each Regional Centre.

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3. AIMS AND LEARNING OUTCOMES

3.1 Aims

The aims of the Chemistry Department are

- to provide an opportunity for all students, regardless of academic background, age, gender, or ethnicity, to study Chemistry at any level, from Foundation to Post-Graduate, in an accessible and supportive environment, using distance-learning methodology;

- to help students to upgrade their knowledge and skills, in the context of strong science programmes, so as to enhance their employability and career development;

- to encourage students to develop skills and attributes that will enable them to engage in life-long learning, and that will also meet the needs of present or prospective employers and contribute to national development;

- to create an environment within the Department, in which members of the staff, both academic and support, can work together harmoniously to further both the Department's educational objectives and also the professional development of individuals;

- to work towards upgrading the Department's facilities, so as to enable both staff and students to engage in better teaching and learning, better research, and better scholarship.

3.2 Learning Outcomes

Upon successful completion of Chemistry courses at the **Foundation Level**, a student should have

- gained a knowledge of the subject material equivalent to that of a student with an A Level pass in Chemistry;

- acquired a thorough knowledge of the subject sufficient to move on to the Level 3 and Level 4 Chemistry courses at the Open University.

Upon successful completion of the **Advanced Certificate Programme in Laboratory Technology**, a student should have

- become familiar with the organisation, management, procedures, and infrastructure of science laboratories;

- become familiar with the operation and maintenance of apparatus and instruments in such laboratories;

- developed skills in common laboratory techniques, and acquired a knowledge of the relevant scientific disciplines, including Chemistry, appropriate to those techniques;

- developed an awareness of safety in the laboratory, and become familiar with the procedures and measures used to ensure the same.

Upon successful completion of Chemistry courses at **Levels 3 & 4 of the B.Sc. Degree Programme,** a student should have

- acquired an understanding of the basic principles of inorganic, organic, physical, and analytical chemistry;

- gained a knowledge of the subject material in the above sub-disciplines at the introductory and intermediate levels;

- developed the ability to use the above knowledge and understanding to solve quantitative problems in the above sub-disciplines;

- become familiar with classical laboratory techniques in qualitative and quantitative inorganic analysis, elementary organic chemistry and physical chemistry, simple separations and synthetic methods;

- developed independent, self-directed learning skills.

Upon successful completion of given Chemistry courses at Levels **3, 4 and 5 of the B.Sc. Degree Programme,** a student should have

- acquired knowledge and understanding of the concepts and subject matter pertinent to the course(s) taken, including laboratory skills if applicable;

- developed an ability to solve problems;

- developed the ability to synthesize solutions from different areas of chemistry and related or relevant disciplines.

Upon successful completion of a research project or literature project in Chemistry at **Level 5**, a student should have

- developed the ability to work independently, seeking and critically synthesizing information, and developing additional laboratory skills if relevant;

- acquired transferable skills, including computer literacy, Internet and library searching skills, English writing skills, and verbal communication and computer-aided presentation skills.

To assist students achieve the above learning outcomes, the Department provides opportunities for students to

- progressively develop their knowledge and skills in the field of Chemistry;
- to undertake an optional research project or literature project, subject to the availability of supervisors, facilities, and other resources, on a mutually agreed upon topic;
- to receive guidance, counselling, feedback on progress, and detailed information on programmes and courses.

4. FINDINGS OF THE REVIEW TEAM

4.1. Curriculum Design, Content and Review

The curriculum introduced in 1985 has been revised in 1995. The next major revision is planned for 2006. The duration for each curriculum revision appears to be too long as the content may be becoming outdated, especially at Level 5. However, the special features of the distance learning methodology may be causing limitations in more frequent major revisions. (Self Evaluation Report – SER – p.10).

A few new courses have been introduced after 1999. This activity seems to be more dependent on the availability of senior academic staff. Discussion with the academic staff revealed that the revision is done on the basis of peer observations.

The course content is presented in the prospectus and is comparable with the courses in degree programs of the conventional universities, and covers sufficient breadth and depth. The design provides high level of flexibility providing openings for students to follow certain advanced courses (level 5) without going through courses at levels 3 and 4 which form pre-requisites. However, in some cases this leads to learning difficulties for the students. The program provides strong multidisciplinary elements through exposure of students to courses such as Laws of Sri Lanka and Management.

It was revealed during the visit that the curriculum does not provide adequate interactive opportunities between students and teachers through modern communication channels. The review team is of the opinion that the mechanisms for such interactions need to be established and documented in the curriculum considering that the OUSL is following a distance education process.

The review team was not able to identify adequate links of OUSL with open universities in other countries to learn and adopt techniques used elsewhere, or to keep abreast of new developments in distant education, during the discussions with the academic staff. Global connectivity to knowledge bases is an important component in development of curricula content and review.

The curriculum design, content and review, is judged as *Satisfactory* based on available information.

4.2. Teaching, Learning and Assessment Methods

The review team was mindful of the fact that the teaching-learning methods in distant education are not comparable with conventional university education techniques. This activity was therefore viewed from a different angle from that of conventional universities.

The mode of teaching is almost totally through the provision of text books written to address the curriculum in each course. The text books are made available to students at registration. Most, but not all text books identify the objectives of the course either at the beginning or the end of the book. The text books contain a few questions for students to assess their competency after following the contents. However, it was observed that the majority of questions are of recall type and do not provide a mechanism for students to think and generate solutions on a logical basis.

Revision of text books more frequently and change of the style of writing to make them user friendly are required, if the expected learning outcomes are to be achieved as the text books form the major course material for students. The lack of guidance for further reading materials, and the belief, as admitted by the students, that what is required to get through the examination is knowing only the text book material, nullifies the aim of developing life long learning skills among students.

There are opportunities provided for discussion classes (day school) for students. The students are expected to mail in advance the questions for discussion at the classes. However, mailing questions to teachers appears to be almost non-existent and the classes are held a day or two prior to the examinations. A few students bring questions to the classes. The attendance in the classes appears to be less than 50% of those registered. It appears as if the students are in a hunt for probable examination questions at these classes. There is not even an introductory class for students at the beginning of the course as admitted by both the teachers and students, which would have been useful in orienting the students to needs of the course.

The reviewers observed that the day school classes take more, the form of teacher addressing individual students on the questions raised by them, rather than getting the students to interact with each other or generate thinking. The second mode of teaching observed was the teacher posing questions for students to work on, during the class and discussing them. Attempts made by one teacher to create discussion through email have not been fruitful due to extremely poor responses from students.

The practical classes are conducted continuously for a period of one to two weeks, to suit the free time available to students who are employed. The handouts given for practical contain adequate information. The introduction and the guidance given by the teacher conducting the practical classes were of high standard and the guidance provided by the demonstrators was observed by the review team to be satisfactory. The overall approach in the practical classes meets very well the aim of developing practical skills in Chemistry among the students. There were three video programs developed demonstrating the practical lessons highlighting dos and do nots. The programs are very effective in guiding the students on skill development.

Other than the practical classes at levels 4 to 5 and seminars given by the students at level 6 there are no mechanisms to develop success skills of students such as leadership characters, interpersonal activities, team work *etc*.

The students are expected to devote 450 hr of work for each credit. Some of the more keen students claimed that they were studying nearly 40 - 50 hr per week while those who are employed claimed 10-15 hr. These values were given by the students at level 5, who attended the day school, appeared keen, and joined at level 3 based on A level results. Their position was that reading the text books for self-learning require repeated reading to understand, and long hours of study are needed. There may be need to make the text books more user friendly and provide mechanisms for interactions with teachers more effectively.

The students confirmed that the teachers are available when the students request them for discussions.

The Teaching, Leaning and Assessment Methods of the programme is judged as *Good*.

4.3. Quality of Students including Student Progress and Achievements

The concept of Open University provides opportunity for anybody above 18 years to enter at the appropriate level and follow the courses. The system operates in five levels. Levels 1 and 2 provide opportunities for students with knowledge below G. C. E. Advanced level and at G.C.E Advanced level to get them upgraded to standard of students at the entry point to the University. Levels 3, 4 and 5 represent the three years of education equivalent to general degree programs in the conventional universities.

No students coming from levels 1 and 2 were present in a limited sample of students present in a level 5 class of 40, visited by the review team. The bulk of the students actively following courses appear to be a mixed crowd from among those who have qualified at G.C.E. Advanced level and could not get a university placement, students with 2 passes in Advanced level and topped up by level 2 learning, and school teachers. A few working in technical grades in institutions were also present.

The quality, commitment and time availability of the students appear to be highly variable making the role of the teachers more difficult. It is also notable that the students following degree programs are those who have not been able to get in to conventional universities following the heavily tuition based Advanced Level examination. From a highly coached tuition back ground to a situation of distant and self-learning requires a diagonally opposite approach of learning.

The low success rates shown in the SER falling into a wide range of 12 to 100% with mean lying below 50% represent a low student progress. On the other hand there is at least one student who has completed degree and joined the academic staff and a few successful in completing M. Phil. Degrees.

Considering the concept of education in an Open University and the extremely high variability of the quality of students at entry, the quality of students in classes, student progress and achievements was judged as *Satisfactory* by the team.

4.4. Extent and Use of Student Feedback, Qualitative and Quantitative

The main channels of student feed back in the system comes from, performance at the practical classes, the quantity and quality of questions directed by mail to teachers prior to day school classes, personal interactions with teachers and occasional questionnaires given to students.

There is some evidence of responses by the teachers to student feed back. In one instance a course in Analytical Chemistry has been redesigned within a very short period of introduction based on student comments, as explained by the teachers to the review team. An e-learning process established by a teacher has brought in only a few responses, that too was close to the examination time. Records of the department meetings indicated discussions based on student feed back. However, the view of a few students was that the use of feed back is low.

Considering the low interactions between the teachers and students, which is essentially a part of distant education, the extent and use of feed back from the students was judged *Good* by the review team.

4.5. Postgraduate Studies

The Department does not contain adequate infrastructure facilities for postgraduate studies in chemistry. Facilities in the undergraduate laboratory and institutions outside the university are used for postgraduate studies by a very limited number of students. Currently there are three students. The driving forces behind the three students appears to be need to qualify with PhD as a staff member, and interest of two academic staff members on research. One student is registered at Sri Jayawardenepura University with co-supervision by OUSL staff.

In relation to the postgraduate studies the judgement of the team is *Satisfactory*.

4.6. Peer Observation

In distant education teacher-student interaction procedure provide little opportunities for peer observation of lectures, the only face to face interaction been at day schools with limited student attendance. Formal peer evaluation does not seem to occur during the interactions.

In preparation of the textbooks which forms the main knowledge imparting procedure, is a committee from among the academic staff of the department review the textbooks. The non-uniformity of style, absence of identification of learning objectives in some books, absence of further reading material and low revision rate for books reflect low level of peer review. There was no evidence of any members outside the department reviewing the books before publication.

In relation to peer observations the judgement of the review team is *Satisfactory*.

4.7. Skills Development

The two main approaches of skill development associated with the program is the practical classes in chemistry followed by all students, the preparation of the research report and a seminar presentation by a few students offering research project as a part of degree program at level 6. These represent mostly basic skill developments envisaged in following chemistry as a subject. As the student interaction is limited to a few groups of individuals working together, because they happen to be employed in one place, the opportunities for development of interpersonal skills is minimal. On the other hand, the students are operating in a wider circle of population, success skills are probably already acquired by them unlike the students in the conventional universities.

In spite of the weaknesses mentioned, the review team feels that the skills development in the programme is *Satisfactory*.

4.8. Academic Guidance and Counselling

At the beginning of the semesters programs the students are given adequate documents, guidance and opportunities to discuss the academic aspects of the program. The discussions focus on how each student should match the study and job requirements. There is a student counsellor for the faculty and two staff members of the department takes up 30 students each for counselling. The interactions between counsellors and students appear to be minimal after this initial interaction.

Due to complex nature of evaluations, delays in release of results, overlaps in time tabling, leading to results being not available for students to apply for graduation appear to be a common problem. There appears to be a problem of quality management in r4elation to administrative component of examination work. Computerization of handling of the results and shifting to a Grade Point average system could provide more effective means of handling examination results keeping the students informed of their progress continuously.

In relation to academic guidance and counselling the judgement of the team is *Good*.

5. CONCLUSIONS

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

Aspect Reviewed	**Judgement Given**
Curriculum design, content and review	Satisfactory
Teaching learning and assessment methods	Good
Quality of students including student progress and achievements	Satisfactory
Extent and use of student feedback, qualitative and quantitative	Good
Postgraduate studies	Satisfactory
Peer observations	Satisfactory
Skills development	Satisfactory
Academic guidance and counselling	Good

Overall Judgment – *Suspended*

6. RECOMMENDATIONS

a) It is recommended that OUSL establish greater links with the Open University system in other countries and use the modern techniques in distant education

b) The Review Team is of the opinion that OUSL needs to use radio, television and e-learning techniques and make available the lessons though website instead of printed form, right from the beginning of courses.

c) It is recommended that the lesson material be modified to make them user friendly, enriching with diagrams (through web) and subjected to frequent revisions.

d) It is desirable to carry out the continuous assessments of students through well designed multiple choice questions to develop logical thinking of students.

e) The Department may consider exposing the staff to concepts of interactive discussions and techniques that are used to enhance active student participation in group discussions

7. ANNEXURES

ANNEX 1

Agenda for the Visit by the Review Team

Day 1 – 20th September, 2005
09.00 – 09.15 Welcome Meeting
09.15 – 09.45 Discussion of the Agenda for the Visit
09.45 – 10.30 Observation of Facilities of the Department
10.30 – 10.45 Tea Break
10.45 – 11.15 Observe Teaching – Practical Class (CHU 1221 – Quantitative Analysis)
11.15 – 11.45 Observe Teaching – Day School (CHU 3237 – Industrial Chemistry)
11.45 – 12.30 Meeting with Students
12.30 – 13.30 Lunch Break
13.30 – 13.45 Meeting with the Dean and the Head of the Department
13.45 – 14.45 Department Presentation on the Self Evaluation Report
14.45 – 15.45 Discussion (Working Tea)
15.45 – 16.30 Meeting with Department Academic Staff
16:00 – 17:00 Brief meeting of reviewers

Day 2 – 21st September, 2005
09.00 – 10.00 Observe Teaching – Practical Class (CHU 1221 – Quantitative Analysis)
10.00 – 11.00 Observe Documents
11.00 – 11.15 Tea Break
11.15 – 12.00 Observe Documents/Watching Videos
12.00 – 12.30 Meeting with the Head of the Department
12.30 – 13.30 Lunch Break
13.30 – 14.30 Meeting with Postgraduate Students
14.30 – 14.45 Tea Break
14.45 – 16.00 Observation of other Facilities
16.00 – 17.00 Meeting of Reviewers

Day 3 – 22nd September, 2005
09.00 – 10.00 Observe Teaching – Day School (CHU 3127 – Organometallic Chemistry)
10.00 – 10.30 Academic Guidance and Counselling Core Aspect Meeting
10.30 – 11.00 Meeting with the Non-Academic Staff of the Department
11.00 – 11.30 Reviewers Private Discussion
11.30 – 12.30 Meeting with Head and Staff for Reporting
12.30 – 13.30 Lunch Break
13.30 – 17.00 Report Writing

ANNEX 2

List of Persons Met During the Visit

- List of Academic & Academic Support Staff Members:
  1. Dr. G. Bandarage, Dean, Faculty of Natural Sciences, OUSL
  2. Dr.(Ms) Sithy S. Iqbal, Head/Department of Chemistry
  3. Prof. J.N.O. Fernando, Professor
  4. Mr. M.R.M. Haniffa, Senior Lecturer
  5. Dr. M.D.A.D. Gunatilleke, Senior Lecturer
  6. Dr. S.R. Hettiarachchi, Senior Lecturer
  7. Mrs. R.U. Tantrigoda, Senior Lecturer
  8. M.D.J.S. Saparamadu, Lecturer(Prob)
  9. M.N.K. de Zoysa, Lecturer (Prob)
  10. K.G. Padmasiri, Lecturer (Prob)
  11. M. Thayaparan, Lecturer (Prob)
  12. M.D. Gunapala, Educational Assistant
  13. D.R. Kulatunga, Research Assistant
  14. L.G. Pathberiya, Temporary Demonstrator
  15. P.T.S. Dharmabandu, Temporary Demonstrator
  16. Dr. M.W.M. Hisham, Consultant in Industrial Chemistry
  17. Dr. (Mrs) G. Jayathilake, Actg. Director, Education Technology Unit
  18. Dr. Rohan Fernando, Student Counsellor, Faculty
  19. Dr.L. S. K. Liyanage, Student Counsellor, University

- Discussions were held with 20 undergraduate students representing level 5 of study and three research students.
- Discussions were held with one non academic staff of the department
- Discussions were held with the probationary lecturers who were promoted recently from the grade of Educational Assistants, who seem to interact more closely with students

ANNEX 3

List of Teaching Sessions Observed

- Practical Class – CHU 1221 – Qualitative Analysis (Preparation of a Standard Solution)
- Practical Class – CHU 1221 – Qualitative Analysis (Solubility Product)
- Day School – CHU 3237 – Industrial Chemistry
- Day School – CHU 3127 – Organometallic Chemistry

ANNEX 4

List of Facilities Observed

- Lecture Theatres and Two Teaching Laboratories
- Office Space and Staff Rooms
- University Main Library
- Education Technology Unit (Audio-Visual Unit)
- Book Distribution Centre

ANNEX 5

List of Documents Observed

- Faculty Prospectus – 2004/2005
- OUSL News Bulletin
- Minutes of the Faculty Board Meetings, Meetings of the Heads of Departments and Senior Staff Meetings of the Department of Chemistry
- Samples of Past Question Papers, Marking Schemes and Moderators' Comments on Question Papers
- Final Year Students' Project Reports, Students' Practical Record Books
- Student Registration Material, Information Sheets for Courses offered
- Samples of Teacher Evaluations by the Students and the Related Forms
- Research Papers and Other Publications by the Academic Staff Members of the Department