SUBJECT REVIEW REPORT

DEPARTMENT OF CHEMISTRY

FACULTY OF SCIENCE
UNIVERSITY OF JAFFNA

04th to 6th July 2005

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, focussing on the student learning experience and on student achievement. 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, University of Jaffna from 4th to 6th July 2005. 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 general and special degree students (see Annex 1), by peer observation of the teaching process (see Annex 2), by observing the facilities at the Department (see Annex 3) and by examining the documents provided by the Department (see Annex 4).

Each of the eight aspects was judged as good/satisfactory/unsatisfactory, noting the strengths, good practices and weaknesses in each. Further, an overall judgement was given as confidence/limited confidence/no confidence.

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

The University of Jaffna was started as the 6th campus of the University of Sri Lanka, in 1974 with the Faculties of Arts and Science. In 1978, with the implementation of the universities Act No. 16 of 1978, Jaffna campus was elevated to the level of an independent and autonomous university as the University of Jaffna. With the addition of four new Faculties, namely Agriculture, Medicine, Management Studies and Commerce and Graduate Studies the university now provides educational opportunities for a broader spectrum of Sri Lankan students.

The main campus of the university is located in Thirunelvely, very close to the Jaffna city centre. In addition to the main campus, the university has one other campus at Vavuniya, which is situated about 90 miles away from the main campus. Vavuniya campus has two faculties (Applied Science and Business Studies), an Academy for fine arts (Ramanathan Academy) and a Department for Siddha Medicine**.**

The vision statement of University of Jaffna is *"to be a leading centre of excellence in teaching, learning, research and scholarship".* The mission of the university is *"to produce intellectual, professionally competent and capable graduates to meet the emerging needs of the national and international community with special emphasis on the social, economic and cultural needs of the Northern Sri Lanka".*

The Faculty of Science was set up initially at Vaddukoddai in the premises taken over from Jaffna College. The first batch of students numbering 103 was admitted in 1974 and only a course in Mathematics & Statistics was offered. Later, in 1975 courses in Physical and Biological Sciences were introduced. The Faculty was shifted to the present location at Thirunelvely in 1978.

The Faculty of Science consists of 6 departments, namely Botany, Chemistry, Physics, Computer Science, Mathematics and Statistics, and Zoology. In the year 2004 the faculty intake was about 130 students and the present student number in the faculty is about 600.

The vision of the Faculty of Science is "*to be a recognized centre of science learning in Sri Lanka".* Mission of the Faculty is "*to produce graduates with balanced knowledge and skill in Science, morals, wisdom and social responsibility to meet the regional and national needs of the science personnel, to foster promote and excel in teaching, learning and*

research in basic sciences and its applications, to disseminate knowledge and resources for the benefit of the society with special emphasis to science education and economic and social development".

The department has 3 cadre positions for professors and 14 for senior lecturers/lecturers that make a total of 17 academic cadre positions. Presently, there is one senior professor, 3 senior lecturers and 8 probationary lecturers, out of which 5 are on study leave. The senior professor (who is on release from the department) is currently holding the post of Rector of the Vavuniya campus. In addition, there are 8 cadre positions for temporary demonstrators. The department has 6 technical officers, 9 laboratory attendants one clerk and two labourers. The total number of students following Chemistry courses in the faculty at present is about 191.

The department has two large lecture theatres, three tutorial rooms and five spacious teaching laboratories. Four of these laboratories have places for about 60 students in each and one laboratory with places for about 30 students. All Final year projects take place in the three research laboratories.

The main library, which is situated close proximity to the department, has a fair collection of textbooks and periodic journals in chemistry. The department also has a small collection of textbooks received by way of donations. They are normally kept in a department cupboard along with research project reports of the final year students.

There are six personal computers in the Department for the use of staff and students. Two of the computers have inter-net facilities. Two computers in the department are especially reserved for the academic staff to carry out confidential work. All students have access to the computers in the faculty computer unit.

3. AIMS AND LEARNING OUTCOMES

3.1 Aims

The aims of the department of chemistry are to provide:

- Degree programmes, which have been carefully designed to target both general and specific needs of students and their future employers.
- a range of challenging learning opportunities, enabling students to develop their academic interests and potential.

- encouragement to students to develop a knowledge base, cognitive abilities and transferable skills that will permit them to contribute effectively to national development and to be well placed to meet the needs of potential employers.
- opportunities for students to develop the skills and enthusiasm required for life long learning.
- a friendly, responsive and supportive departmental environment that is conducive to enthusiastic learning, high standards and good completion rates.
- a stimulating opportunity for students from other departments in the university to study chemistry at a level appropriate to their needs.
- support for teaching staff in their career development.

3.2 Learning Outcomes

On successful completion of anyone of these programmes of the department, students will have:

- gained knowledge and conceptual understanding of areas of chemistry.
- learnt how this knowledge and understanding can be applied to research.
- developed a range of personal and transferable skills, which will enable them to apply to varied situations.
- learnt technical and intellectual skills necessary for the acquisition and analysis of data through laboratory work.
- developed their ability for critical and self-directed learning.

On successful completion of all specific programmes, students who offered chemistry should have obtained knowledge and understanding:

- in structure, nuclear and electronic properties of atoms and molecules including electrode reactions, chemical kinetics and molecular spectra.
- in analytical and industrial chemistry, chemistry of group elements including noble gases, transition and inner-transition elements, phase equilibria and chemical and statistical thermodynamics.
- in stereochemistry, syntheses and reactions of different classes of organic compounds including reaction mechanisms and intermediates, application of physical methods in organic chemistry, rearrangement reactions, chemistry and biosynthesis of natural products.

In addition to the above, those who followed B.Sc. (honours) degree programme in chemistry should have obtained knowledge and understanding:

- in theoretical and practical aspects of different spectroscopic techniques in chemistry advanced studies on nuclear and electronic properties of organic and inorganic compounds, stereochemistry, conformational analysis and designing synthetic methods for organic and inorganic compounds.

4. FINDINGS OF THE REVIEW TEAM

4.1. Curriculum Design, Content and Review

The faculty presently offers three degree programmes: B.Sc (General) degree of three year duration, B.Sc (Honours) degree of four year duration, and B.Sc (with education) degree of four year duration. Faculty is also contemplating to start a B.Sc Joint Honours degree programme of four-year duration. There is a provision for students in the three-year degree programme to obtain either a Certificate in Science at the end of first year or Diploma in Science at the end of the second year. During the past only a small number of students have left the degree programme with a certificate or a diploma.

At present there are two groups of students in the Faculty of Science following two different course structures. The first and second year students follow the modularised, credit valued course unit system introduced in 2003. The third and fourth year students have been following the semester based old system of the faculty, where the evaluation is limited to end of semester examinations. In the semester system, each unit has been defined as approximately 45 hours of lectures and tutorials or 120 hours of practical work.

In the course structure introduced in 2003, there are four types of course units, namely core courses, elective courses, auxiliary courses with credit value and auxiliary courses with no credit value. A student who would take chemistry as a principle subject may have to take a combination of course units consist of core courses, elective courses and auxiliary courses. It is the opinion of the review team that the new course structure provides the students with flexibility of selecting courses from a wide spectrum of course units.

In both course structures, selection of students to the honours degree programme is based on their performance at the first and second year examinations.

From traditional system of three terms of teaching and holding examinations annually which was the practiced at the inception, the faculty changed over to semester based course unit system in 1992, where examinations were held at the end of each semester. Subsequently, in 2003, a Faculty Curriculum Committee comprising Dean, Faculty of Science, all Heads of Departments and three senior academics nominated by the faculty formulated a new modularised credit valued semester based course unit system of teaching. One of the main features of the system is continuous assessment of each course unit with in-course assessments and end of course assessment examinations.

The course units offered in the first and second years of study of the semester-based system are aimed at providing basic theory knowledge and practical skills in chemistry. In the first two years of study, units in General and Inorganic Chemistry, Physical Chemistry, Organic Chemistry and Practical Chemistry are offered by the students. Students who would opt to follow a general degree programme will complete the final year by following course units at a higher level.

Honours degree units in Chemistry have been designed to provide in-depth knowledge of the subject at an advanced level. Therefore, in addition to the above, fourth year students are taught many advanced topics such as spectroscopic techniques, design of synthetic methods for organic and Inorganic compounds etc.

Similar to the semester system, in the GPA system too levels 1 and 2 courses concentrate on the basic chemistry course units. In addition, at level 2, student has to offer elective course units in chemistry covering subject areas such as electron deficient compounds, chemistry of poly nuclear aromatic hydrocarbons etc. Syllabi for levels 3 and 4 course units are still under preparation.

It was revealed that since inception, only two major curriculum revisions were undertaken: one in 1992 and the other in 2003, although there had been several minor changes in the syllabi effected from time to time. The discussions held with students, who represented all four years indicated however that there is no mechanism to get their feed back on curriculum revision. Review team suggests that it is appropriate to obtain the views of the students also in future major curriculum revisions.

In relation to the curriculum design, content and review, the judgement of the review team is good.

4.2. Teaching, Learning and Assessment Methods

Most common method of imparting knowledge is by way of lectures, which are carried out, in the two spacious lecture theatres. All new entrants are required to undergo a two-week intensive English course before they follow subject courses. First year lectures in the subject are normally conducted bilingually. This has benefited the majority of students who had done their advanced level studies in Tamil. In subsequent years the medium of instruction will be in English. Tutorial classes are conducted periodically to facilitate the learning process. These would have been very interactive sessions as far as subject matter is concerned. The chalkboard is the most common teaching aid used at present. Some staff members use audio-visual aids to simplify the complicated subject matter by illustrations. Handouts are given when and where necessary. It was observed by the review team that there is an improvement with regard to the issuance of tutorial handouts individually to students with the introduction of GPA based course unit system.

Department has spacious and well-ventilated laboratories conducive for teaching and learning. However, the review team was highly concerned about laboratories functioning without fume cupboards, although there are provisions for installation. We felt that special attention has to be paid for health and safety measures in all laboratories. We feel that the efficiency of certain practical classes can be further increased by providing students with handouts which will definitely help them to plan the practical especially in the third and fourth years. Non-availability of a glass blowing unit is a major draw back for both the general and research laboratories. Its importance is immediately felt whenever a valuable glass item is broken.

There are only a limited number of basic instruments to carry out the Physical chemistry practicals. In most cases only one instrument of each type is available. All Final year research projects are carried out in the three research laboratories where minimum facilities and equipment available for research.

The review team was able to attend some lectures conducted by the staff. It is the opinion of the review team that the quality of teaching of junior staff members needs to be improved to make lectures more interesting and interactive. This may have been a reflection due to the lack of staff training unit and the need of such a unit is highlighted.

It was found by the review team that there is a fair collection of textbooks and journals in chemistry are available in the main library. However, according to the students, the number of copies of standard textbooks is inadequate and the latest editions are not available. In general, students are happy with the IT facilities available at the main computer centre adjoining the library.

In the system existed until 2003, evaluation of the course units was limited to end of semester examinations both for practical and theory units. There was a significant contribution to the final evaluation from the fourth year research project for honours degree students. Subsequently with the introduction of GPA based system of evaluation, in-course assessments were introduced in addition to the end of course examinations. In- course assessment for theory units consists of tutorial-based tests and quiz tests. The review team appreciates the inclusion of a written question paper for the practical unit. In the new system of evaluation, 45% is allocated for in- course assessments whereas end of course examination carries 55% of marks. However, during the discussions, the students expressed their dissatisfaction over in-course assessments. Their main complaint was the large number of theory assessment tests (for example a total of 150 tests for all three subjects for first year students in the year 2004). Most of these tests have been scheduled for Monday mornings. As a result the students have very limited time for additional reading as well as extra curricular activities.

The question papers of the end of course examinations are compatible with that of any other university. Internal examiners or external examiners from other universities moderate them. For the general degree the second marking of answer scripts are normally being carried out by the internal staff. We noticed that, initially, the in-course assessments questions were very much similar to end of course examination questions. Such questions are not suitable for the intended purpose. We are glad to note that this has been identified and rectified by the staff. It was revealed that fourth year question papers are moderated by foreign examiners who are also involved in second marking of scripts.

The review team feels that the Teaching, Leaning and Assessment Methods of the programme are satisfactory.

4.3. Quality of Students including Student Progress and Achievements

Students to the faculty of Science are selected by the UGC according to the national admission policy. As revealed during the discussions held with staff, the department has been able to attract clever students to the special degree programme who have scored high marks during the first two-year examinations.

Progress of students in chemistry is monitored by tutorial work, practical work and by summative examinations at the end of each semester/ unit as applicable. With the introduction of GPA based evaluation, it is possible to monitor the progress of students more regularly. Progress of the final year research projects is monitored regularly by respective supervisors.

The General Degree Graduates who have offered chemistry as a subject normally finds employment in the education sector. It was revealed that a high degree of success has been achieved by students of B.Sc. (honours) degree programme during the last five years. Almost 67% of students have obtained at least second-class upper division pass. As indicated in the Self Evaluation Report, 21% of these graduates have secured permanent employment in the field of chemistry while 35% have opted for higher studies.

In relation to the quality of students, student progress and achievements the judgement of the team is good.

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

At present, formal and informal methods are used to obtain students' feedback. The review of documents available at the department indicated the use of structured questionnaires to obtain student feedback on teaching of certain course units, which was initiated in 2004. This indicates the keenness of some staff members to identify their weaknesses and to improve quality of their teaching.

It was revealed that informal feedback is obtained mainly through temporary demonstrators and junior staff members. Further, it was noted that the results of the student feedback is neither analysed nor interpreted formally. The review team feels that a formal mechanism of using student feed back should be extended to all course units and analysed in a systematic manner.

In relation to the extent and use of student feedback the judgement of the team is satisfactory.

4.5. Postgraduate Studies

Due to lack of qualified staff and facilities, there is no ongoing research in the department leading to post-graduate degrees. However, it was revealed during discussions with the staff members, that the department is exploring the possibilities to carry out joint research programmes with other universities.

At present, two senior staff members are actively involved in the teaching of M.Sc. in Physics of Materials programme, conducted by the department of Physics. Further, approval has already been granted by the university to start a M.Sc. course in Industrial Chemistry. Recent research publications of some department staff members indicate the potential and capability for further development in this aspect. The review team felt that the post-graduate studies in the department could be enhanced with the collaboration of researchers in the same field in other universities and research institutions.

In relation to the postgraduate studies the judgement of the team is satisfactory.

4.6. Peer Observations

There is no formal mechanism for peer observation in the department. However, the teaching conducted by newly appointed staff members is usually monitored by senior staff members and informal feedback is given. It was observed by the review team, that practical classes are conducted under supervision of senior staff members providing opportunity for the junior members to rectify their weaknesses.

The review team however suggests exploring the possibility of implementing a formal or an informal mechanism for peer observation. Senior academic members within or outside the department could be invited for the process.

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

4.7. Skills Development

The department provides opportunities for students to develop transferable skills required by a chemistry graduate, by having a well-structured curriculum and a laboratory

practical component during all four years. In addition, we observe that B.Sc. (Hons) degree students are required to present a library based project seminar, through which they develop a wide range of skills such as communication skills, analytical skills etc. We feel that it is worthwhile to extend a similar exercise to general degree students as well. Here the presentation may involve a practical impossibility and therefore the review team feels that only submission of a written report would be adequate.

It was transpired during the discussion with the students, that they have neither undergone any sort of industrial training nor undertake any industrial visits. The review team strongly feels that the department should make arrangements for such visits/training as early as possible for the benefit of the students probably in their fourth year.

Students improve their language skills and communication skills in English by following subject courses in English medium beyond first year, and also by following auxiliary English courses. Further, several course units such as Computer literacy and application packages, Communication skills, Sri Lankan Studies, Social Studies etc. are offered as auxiliary courses with a view of producing a university graduate with a broad based knowledge. The review team is impressed by the activities conducted by the Chemical Society, which will also lead to the development of certain skills such as leadership qualities and organizational skills in students.

The review team observed that the technical staff of laboratories was given limited opportunities for their skills development. Hence it is recommended to explore the possibilities of providing required training for them.

The review team feels that the skills development in the programme is satisfactory.

4.8. Academic Guidance and Counselling

In a preliminary briefing session the Dean informed that, a well-planned orientation programme of two weeks duration is usually being conducted for the new entrants by the faculty. Information regarding the degree programme and other activities of the faculty and the university are being provided in this programme.

Academic guidance and counselling are being done both at university and at faculty levels. In general, each faculty has one student counsellor appointed by the Vice Chancellor. In addition, course advisors appointed by the department help the students in the selection of

subject combinations/course units. Course advisors are of the opinion that this scheme is well used by the students.

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	Good
Teaching learning and assessment methods	Satisfactory
Quality of students including student progress and achievements	Good
Extent and use of student feedback, qualitative and quantitative	Satisfactory
Postgraduate studies	Satisfactory
Peer observations	Satisfactory
Skills development	Satisfactory
Academic guidance and counselling	Good
Overall Judgment	**Suspended**

As informed by the staff, the academic activities of the department have been badly affected at least twice during the past: in 1988 and in 1995 due to war situation in the Jaffna peninsula. In spite of these, academic staff of the department has been able to maintain the teaching activities at a reasonably good standard, which could be attributed to their untiring efforts and the dedication. However there are several aspects, which need careful attention and improvement.

Overall Judgment - *Suspended*

We believe with time, that young staff of the department will soon gather the necessary experience and improve the shortcomings soon and noted that they have the strength and courage to do so.

6. RECOMMENDATIONS

- It was observed that there are no time intervals between two consecutive lectures in the Time Table. The review team recommends at least 5 minutes gap between two lectures and 15 minutes tea interval in the morning session be introduced. We hope that department staff is in a position to convince the faculty in this regard.
- There are about 8 probationary lecturers in the department and they should be encouraged to pursue their post-graduate education in different areas of chemistry so that department will have staff members with multitude of specialization.
- Even though the laboratories are spacious and well ventilated, the safety measures are not satisfactory. It is strongly recommended to install fume cupboards as early as possible and fix fire extinguisher to each laboratory. The review team also feels that the department should provide safety goggles to students and insist them to wear them during the practical sessions.
- It is recommend to train a technician in glass blowing and establish a unit with necessary equipment.
- Provide funds to purchase necessary laboratory equipment for undergraduate practical classes especially in the fields of physical and analytical chemistry.
- Students have not got any opportunity to interact with the industry. The department should seriously think of arranging industrial visits/training for students majoring chemistry.
- It is strongly recommended to improve IT facilities including the internet facilities at the department.
- It is recommended to invite qualified staff from other universities to deliver a short series of lectures of one to two weeks duration which will give the students better opportunity of interacting with senior and experienced academics.

7. ANNEXURES

ANNEX 1

List of Persons Met During the Visit

- List of Academic & Academic Support Staff Members:
  1. Prof. R. Kumaravadivel, Dean, Faculty of Science, University of Jaffna
  2. Dr.(Mrs) M. Senthilnanthanan, Head/Department of Chemistry
  3. Dr. J.P. Jeyadevan, Senior Lecturer
  4. Mr. K. Velauthamurty, Lecturer(Prob)
  5. Ms. A. Mahendralingam, Lecturer (Prob)
  6. Ms. T. Thiruchchelvi, Temporary Assistant Lecturer
  7. Ms. R. Subhagini, Temporary Demonstrator
  8. Ms. K. Rajadevi, Temporary Demonstrator
  9. Mr. M. Mariagnanaseelan, Temporary Demonstrator
  10. Mr. G. Sashikesh, Temporary Demonstrator
  11. Mr. J. Jegathesh, Temporary Demonstrator
- Discussions were held with 98 students representing all four years of study including general and special students.
- Discussions were held with one Technical Officer.

ANNEX 2

List of Teaching Sessions Observed

- Practical Class – CHG 34 - Practical Chemistry III
- Practical Class – CHS 33 - Practical Chemistry I
- Practical Class – CHS 44 - Advanced Practical Organic Chemistry
- Lecture – CHE202GC3 - Atomic and Molecular Structure & Basic Principles Spectroscopy
- Lecture – CHG 33 - Organic Chemistry III
- Lecture – CHS 42 - Advanced Organic Chemistry II

ANNEX 3

List of Facilities Observed

- Lecture Theatres and Tutorial Rooms
- Office Space and Staff Rooms
- Laboratories (Five Teaching laboratories and Three Research Laboratories)
- University Main Library and Computer Centre

ANNEX 4

List of Documents Observed

- Faculty Hand Book – 1998 (Old System)
- Structure & Syllabi of B.Sc. Degree Programme (First & Second Years) – 2004 (New System)
- Samples of Past Question Papers, Marking Schemes, Answer Scripts and Mark Sheets
- Moderators' Comments on Question Papers, External Marking Examiners' Comments
- Final Year Students' Project Reports, Students' Practical Record Books
- Samples of Teacher Evaluations by the Students and the Related Forms
- Research Papers and Other Publications by the Academic Staff Members of the Department