

# **SUBJECT REVIEW REPORT**

**DEPARTMENT OF PHYSICS**



**FACULTY OF SCIENCE  
UNIVERSITY OF JAFFNA**

04<sup>th</sup> to 6<sup>th</sup> July 2005

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## SUBJECT REVIEW REPORT

**Department:** Physics  
**Faculty:** Faculty of Science  
**University:** Jaffna  
**Date(s):** 4<sup>th</sup> to 6<sup>th</sup> July 2005  
**Reviewers:** Prof. D.A. Tantrigoda, Prof. W.P. Siripala and  
Prof. B.S.B. Karunaratne

### 1. PURPOSES AND AIMS OF THE SUBJECT REVIEW

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

This report describes the outcome of a review carried out to evaluate the quality of the academic programmes and related issues in the Department of Physics of the Faculty of Science of the University of Jaffna during the period from mid 1999 to mid 2005. In this exercise the following aspects were examined and evaluated.

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

There has been a major curriculum revision in the Physics Department in the latter part of 2003. As the old curriculum has been in operation for more than 75 % of the review period, more emphasis has been laid on the activities carried out under this curriculum. However, the matters related to the new curriculum have also been

discussed in some detail under Curriculum Design, Content and Assessment. Further, some comments on the new curriculum too have been made in the remaining sections of the review report.

## **2. BRIEF HISTORY AND THE CURRENT STATUS OF THE UNIVERSITY AND THE DEPARTMENT**

The University of Jaffna was first established in 1974, as the Jaffna Campus of the University of Sri Lanka. Initially the campus had two faculties, namely Science and Humanities, which offered courses that lead to the B.Sc. and B.A. Degrees respectively. First batch of 104 students were admitted in October 1974. 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. The main campus of the University is located in Thirunelvely in Jaffna in a forty three acre site. Later four new Faculties, Agriculture, Medicine, Management Studies and Commerce and Graduate Studies were added broadening the educational opportunities provided by the University.

In addition to the main campus, the University has another campus at Vavuniya with two faculties (Applied Science and Business Studies) and an Academy for fine arts (Ramanathan Academy) and a Department for Siddha Medicine. The Mission of the University is

*to be a leading centre of academic excellence in producing intellectual, professionally competent and capable graduates to meet the emerging needs of the national and international community with special emphasis on the social, economical and cultural needs of northern Sri Lanka.*

Faculty of Science is the second largest faculty in the University as far as the student numbers is considered. Present student population of the Faculty is about 600 while the present annual intake is about 180. As any other well-established Science Faculty, Jaffna University Science Faculty also has six academic departments. They are Botany, Chemistry, Computer Science, Mathematics and Statistics, Physics and

Zoology Departments. 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.*

Faculty of Science of the Jaffna University offers two study programmes at the undergraduate level namely the B.Sc. General Degree Programme and the B.Sc. Honours Degree Programme. B.Sc. General Degree Programme is of three-year duration and courses from three disciplines are being offered in this Programme. B.Sc. Honours Degree is of four-year duration and courses mainly from one discipline are being offered in this programme. Up to 2003 there has been a semester based course unit system was in operation. Each unit has been defined as approximately 45 hours of lectures or 120 hours of practical work. Students are selected for the Honours Degree Programme at the end of the second year based on the performance of course unit examinations of the first two years of the relevant subject.

A new modularised credit valued semester based course unit was introduced from the academic year 2003/2004. In this system 15 hours of lectures and tutorials or 30-60 hours of laboratory or fieldwork is equivalent to one credit.

Department of Physics, which is under review, was established in 1975 in Vaddukoddai, a premises taken over from the Jaffana College. The Department was shifted to the better-equipped Natural Science Block in the in Thirunevel in 1978. Building in which the Physics Department is presently housed was completed in 1980. The Vision of the Department of Physics is

*to be a leading centre in teaching, learning, research and scholarship in Physics.*

The Department has one spacious lecture hall, which can accommodate about 200 students, and three small lecture rooms, which can accommodate about 50 students

each. The Department also has two well equipped spacious laboratories that are being mainly used for the General Degree programme and each of these laboratories can accommodate at least 60 students. In addition, there is a laboratory reserved for the Honours Degree Programme and a Spectroscopy Research Laboratory recently established from assistance received from the National Research Council of Sri Lanka.

The Library, which is situated in the near proximity of the Physics Building, has a reasonable number of Physics textbooks. However, there is a dearth of latest textbooks and popular current journals adversely affecting the research activities of the Physics Department. Inadequate funding is cited as the main reason for this situation. In addition to the main library, the Department also maintains a small library, which has a reasonably good collection of essential Physics textbooks donated by well wishers.

The University was provided with computer facilities recently. All the senior members are now provided with a personal computer and there is common pool of computers that are at the disposal of the probationary and temporary lecturers. Students have the access to the computers in the above pool and in the computer unit of the University.

There is one Senior Professor, one Professor, four Senior Lectures and four Probationary Lecturers in the Department. The Senior Professor, Prof. R. Kumaravadivel is presently holding the post of Dean of the Faculty of Science. Three of the Probationary Lecturers are undergoing postgraduate training abroad. Professor K. Kunaratnam, Founder Professor of Physics who retired in 2000 is still actively contributing towards teaching and research activities of the Department as an Emeritus Professor. There are nine Temporary Demonstrators in the Department. Department has a Computer Application Assistant, five Technical Officers, six Laboratory Attendants, and a Labourer.

Reviewers noted that the academic activities of the University including the Physics Department have been frequently affected by the war situation that has been prevailing in the Jaffna peninsula. However the effort that is being made by the academic staff of the Physics Department to maintain a higher standard in their teaching activities in spite of numerous obstacles is truly commendable.

### **3. AIMS AND THE LEARNING OUTCOMES PROVIDED BY THE DEPARTMENT**

Aims of the courses offered by the Department of Physics are to

1. provide the undergraduates a thorough knowledge of the fundamental concepts in Physics and their application through a series of theory course units based on a standard university Physics curriculum;
2. train the undergraduates in the development of various experimental skills via laboratory classes;
3. encourage the students to develop a knowledge base, cognitive abilities and transferable skills that will permit them to contribute effectively to teaching, research and/ or other carriers (whether or not related to their undergraduate programme);
4. encourage students who are majoring Physics (single honours degree), to pursue their future carriers in academic or research institutions by offering them more advanced courses, laboratory classes and research projects;
5. provide a friendly, responsive and supportive departmental environment that is conducive to enthusiastic learning.

#### **Learning outcomes (Objectives)**

On successful completion of the courses provided by the Physics Department, students should have achieved the following general objectives.

1. Gained knowledge and conceptual understanding in fundamental and modern physics, based on course units that provide initial broad frameworks followed by progressively increasing depth of study.
2. Developed a range of personal and transferable skills such as critical ability, independence of thought, data handling and interpretation, computer skills\*, oral and written communication.
3. Learnt technical and intellectual skills necessary for the acquisition and analysis of data through laboratory work.

4. Learnt how to carry out an independent research project and write scientific reports based on the results\*.

Note: \* applicable only to the honours degree students.

On successful completion of the each of the following programmes, students should have achieved the following specific objectives.

1. **B.Sc. (General) Degree with Physics as a main subject** Knowledge and understanding of fundamental principles in the areas of mechanics, waves, vibrations, electricity, magnetism, A.C. theory, electronics, thermal physics, statistical physics, optics, acoustics, structure & properties of matter, electromagnetism, special theory of relativity, quantum mechanics and physics of atoms, nuclei and particles.
2. **B.Sc. (Honours) Degree in Physics** Knowledge and understanding of the above topics at the general degree level and of advanced topics in classical mechanics and relativity, quantum mechanics, electronics & computing, statistical physics & thermodynamics, electromagnetism, optical physics, solid state physics, nuclear physics & particle physics.

#### **4. OVERALL JUDGMENT - *Suspended***

### **EVALUATION OF DIFFERENT COMPONENTS**

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

**4.1.1 Curriculum Design:** Physics Department conducts courses for both General and Honours Degree Programmes. A Joint Honours Degree has also been contemplated, but has not commenced due to various reasons.

Physics component of the General Degree Programme comprises twelve course units spread over three years. Honours Degree curriculum comprises all the General Degree units and additional twelve special units which cater for in depth understanding of Physics. Four of the Honours level units are offered at the third year while the remaining eight units are offered at the fourth year.

It is also possible to offer Physics as an optional subject and subject content is limited to six units spread over three years in this case. Students who do not offer Physics as a

main subject are also given an opportunity of offering two optional course units in electronics in each of the three years since 2000.

However, with the introduction of the new system number of credits and credit value has changed for both General and Honours Degrees.

**4.1.2 Content:** Physics curriculum has been design on the assumption that most of the students who read for the General Degree end up as teachers while those who read for the Honours end up either as university academics or researchers. Therefore more emphasis has been laid on the fundamental aspects of Physics in the design of the curriculum. Further curricular of several local and British universities have been consulted before designing it. In the curriculum design it has been also assumed that students entering the university have widely varying levels of Physics knowledge and as a remedial measure an attempt has been made to bring all of them to the same level by offering units that provide broad introduction to fundamental topics and are mainly a revision and extension of the Advanced Level topics. Mechanics, waves & vibrations, electricity & magnetism, atomic physics and optics together with practical physics are units offered at the first year level. Practical units have been designed to develop systematic approach of experimental work to gain necessary skills and understanding of working and capabilities of apparatus.

In the second and third years students are being introduced to more intellectually challenging aspects of Physics. A.C. theory, electronics, thermal & statistical physics, structure & properties of matter and practical physics units are offered at the second year level while acoustics & optics, electromagnetism & special theory of relativity, quantum physics & physics of atoms, nuclei & particles and practical physics units are being offered at the third year level.

**4.1.3. Review:** Curriculum of the Physics Department has been revised five occasions since its inception in 1975. Latest revision came into effect in the academic year 2003/2004. Before that it was revised in 1992. At present the curriculum revised in 1992 as well the latest curriculum both are in operation.

A Faculty Curriculum Committee comprising Dean, Faculty of Science, all Heads of Departments and three senior academics nominated by the faculty was appointed in mid 2002 and formulated a new modularised credit valued semester based course unit system. This new system was implemented in 2003/2004 academic year. Present first

and second year students are studying under the new system. One of the notable features of the new system is giving increased emphasis on “in course” or continuous assessments. In this process, 40% of evaluation is done continuously during the course by in course assessments and 60% is done at end of the course by written examination. Electives such as Medical Physics, Industrial Chemistry and Environmental Science have also been incorporated into the curriculum.

With the introduction of new system, course contents were revised as mechanics, relativity & structure of matter, fields, vibrations & waves, solid state physics & electronics, electromagnetism & optics, industrial materials, computational physics. basic electronics, analogue electronics, practical physics, thermal & statistical physics modern physics, medical physics, basic astrophysics & digital electronics

Contents of Honours Degree under the revised system are classical mechanics & relativity, quantum mechanics, electronics & computing, practical physics and project, statistical physics & thermodynamics, electromagnetic theory, optical physics, solid state physics and nuclear physics.

Department of Physics has well understood the need of curriculum revision regularly and has made a genuine effort to improve its curriculum. Professor R. Kumaravadivel, present Dean who is holding the Chair of Physics has given leadership in the curriculum revision process. As such, reviewers observe that the curriculum design content and review aspect in the Dept. is good.

## **4.2. Teaching, Learning And Assessment Methods**

### **4.2.1 Teaching and Learning Activities**

Physics Department mostly uses traditional teaching methods in imparting the knowledge. Lectures, practical work and tutorial classes are main methods that are being used in the teaching process.

At the first year level courses are being conducted in bilingual (Tamil and English).

Rest of the programme is conducted in the English medium.

**4.2.1.1 Lectures:** Lectures are based on subject specific information and attempt has been made to inculcate enthusiasm towards the subject in the lectures. A list of references is normally given for each lecture series so that the student can explore further and enrich their knowledge. Department has realized the importance of use of

modern technology to assist the teaching process and plans are underway to purchase the necessary equipment.

**4.2.1.2 Tutorial Classes:** Tutorial classes are held regularly in small groups of about 10-12 students providing a better opportunity for students to interact with the teacher. Student centered approach is used in the tutorial classes and it is conducted in the form of a discussion. Tutorial classes at the General Degree level is normally conducted by the probationary lecturers while at the Honours Degree level these classes are conducted by senior staff members. As a way of encouraging students to work out tutorial problems, regular tests based on those problems are being held in the new system.

**4.2.1.3 Laboratory Classes:** In each year students spend about 120 hours in the Laboratory conducting experiments, which help them to further develop subject, related knowledge and transferable skills. Normally laboratory classes are held in parallel with the relevant lecture courses so that the students develop a better understanding of the subject through actual observations and measurements.

**4.2.1.4 Literature Projects:** Literature projects and seminars are also an integral part of the General Degree Physics Programme. Skills such as assimilating and evaluating information, critical appraisal of research papers, organization and time management and presentation by undertaking such projects.

**4.2.1.5 Research Project (Honours Degree):** All Physics Honours students have to undertake a research project in the second semester of the final year. They are expected get a sound understanding of research methodology in Physics through these projects in addition to developing special laboratory skills and other transferable skills. The student himself normally does the selection of a project and if the project is of expected standard he will be allowed do it under the supervision of a senior staff member of the department. Most of the projects require a fair amount of use of computers through which the students get experience in using some of the application packages.

## **4.2.2 Assessment Method**

**4.2.2.1 Theory Examination:** The Faculty has been using a uniform semester based assessment scheme since 1992. At the General Degree level, students have to sit for

one theory paper at the end of the first semester and two theory papers at the end of the second semester. Duration of all theory papers is two hours. Examination of all Honours Degree course units is held at the end of the second semester. Each unit is equally contributing towards the final results. Class average for most of the units is slightly above 50 indicating students are performing well in the examinations.

With the introduction of the new system students are being evaluated at the end of each unit. In addition several short tests are conducted during the course of each unit. Monday mornings are specially allocated for this purpose.

**4.2.2.2 Practical Examination:** Examination of all practical units is held at the end of the second semester. Duration of practical examination at General Degree level is two hours while that at the Special Degree level is four hours. No contribution comes from the laboratory course work to the examination at the first year level. However, at the second and third year levels, laboratory course work contributes 5% and 15% of the final mark. At the Honours Degree level, contribution of the course work is much higher and varies from 25% to 50%. The research project carried out by the Honours Degree students are assessed at three levels; proposal stage, dissertation stage and seminar presentation stage.

**4.2.2.3 Examiners:** All examinations are conducted by the qualified examiners appointed by the vice chancellor on the approval of the senate. Normally lecturers who conducted the relevant course unit will be appointed as examiners. However, when a probationary lecturer teaches the course unit, a senior staff member does the evaluation.

**4.2.2.4 Moderation and Second Marking:** All the question papers are moderated by a senior academic in the Department who would also function as the second examiner. Second marking is carried out independent of the first marking. In case of the Honours Degree Programme, Dr. Vincent Smith, Reader in Physics at the Bristol University is functioning as the second examiner. Feed back get from the second examiner is often used to improve the quality of the courses. Dr. Smith has maintained a close relationship with the Department and has visited the Jaffna University and even participated in a Special Senate Meeting and a Departmental Committee Meeting. Comments and remarks made by him on the question papers testify that Honours Degree question papers of Physics Department and their evaluation are of the expected standard.

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

### **4.3 Quality of Students, Student Progress and Achievements**

#### **4.3.1 Quality of Students**

Students are selected on the basis of their achievements at the G.C.E. Advanced Level Examination. Faculty of Science of the Jaffna University like any other Science Faculty finds difficult to attract students who secured higher Z-score values at the G.C.E. A/L Examination. There is a very high tendency for them to opt for professionally oriented courses such as Medicine and Engineering due to socio-economic reasons. This situation has been aggravated due to reluctance of students who selected for the science degree programme under the island wide merit list to get admitted to Jaffna University due to the war situation presently prevailing in the northern region of the country. Within the Faculty the subject that is in high demand is Computer Science and first option of majority of the students when selecting a discipline for specialization is also the same subject. As a result of this the Physics Department does not always get the best students in the Physical Science stream to read for its Honours Degree programme.

Review team had a lengthy meeting with the students and in this meeting it was revealed students are well articulated and have good communication skills. All of them have good future goals and seem to be working towards achieving them.

#### **4.3.2 Student Progress**

Progress of the students while following a course unit is monitored in tutorial classes. This method does not seem to be working satisfactorily due to poor submission of tutorials and duplication of others works. Performance in the practical classes are being assessed continuously and students are advised on how to overcome their weaknesses and improve the expected skills.

Majority of students complete the programme successfully and there are very few dropouts. Performance at all course unit examinations seems to be very good. There is a good distribution of marks obtained in each unit testifying the validity of the evaluation.

#### **4.3.3 Student Achievements**

Department has not carried out any formal surveys to ascertain the job-profile of the past students. However, it is generally known that most of the General Degree graduates who have offered Physics as a subject finds employment in the education sector. Those who have offered Computing and Physics as subjects have secured employment in the IT industry.

Most of the Honours Degree graduates prefer to pursue further studies abroad especially in UK and USA. Usually they end up as researchers or university teachers once completed the postgraduate studies. No detailed statistics regarding their performance and progress are available.

However, reviewers are of the opinion that the Quality of Students, Student Progress and Achievements are good.

#### **4.4. Student Feedback**

There was no formal mechanism to obtain student feedback. Views of the students regarding the course units were obtained through informal discussions with students and through recently passed out students who have been employed as temporary demonstrators having closed contact with the students. The Review Team feels that this is not a suitable method as it provides second-hand information. It may be dangerous to carry out changes based on such information, as they could be misleading. Reviewers are glad to note that the Department has now realized the importance of formally obtaining the feedback from the students and a questionnaire has been prepared for this purpose.

Therefore the Department deserves a satisfactory grade for the student feedback aspect.

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

Department has recently commenced an M.Sc. Degree Programme in Physics of Materials with the Graduate Faculty of the University. This programme has been partly funded by the Asian Development Bank Science and Technology Personal Development Project. The first batch, which was recruited in 2004 January, has 19 students. They have completed the theory component of the course and working on their research projects.

At the moment the Department does not have a research degree programme. The review team feels now it is the correct time to contemplate on starting such a research programme. Senior staff members are too much burdened with administrative responsibilities. Therefore young qualified staff should be encouraged and facilities should be provided to commence research projects that can lead to research degrees. There are five staff members who have doctoral degrees in Solid State Physics and allied fields. There is a lack of recent books and relevant journals in the library and this situation has to be rectified soon.

Considering the difficulties encountered by the University in general and the Department in particular the reviewers believe that Department has made a good progress with regard to postgraduate studies. As such reviewers grade this aspect as good.

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

There is no regular effective peer observation process. However, an informal peer observation system is practiced and the junior academics are continuously monitored and informal feedback is provided whenever necessary. Further, a certain amount of peer observation is taking place in practical classes and also in the moderation process of question papers, which is very often carried out by Prof. Kunaratnam.

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

#### **4.7. Skills Developments**

Physics curriculum has been designed in such a way that it provides opportunities for students to improve their practical as well as transferable skills. In addition, through the theoretical course units such as quantum mechanics logical and analytical thinking of the students are improved considerably. Physics course has a reasonably large component of analogue and digital electronics providing essential skills needed for operating and handling modern equipment. Further they get an opportunity to develop their skills related to computers and application packages. Seminars, poster presentations and report preparation, which are compulsory activities of the programme, enhance written and oral communication skills of the students.

In view of the above skills development aspect has been graded as good.

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

Generally students are guided with regard to academic matters by the academic staff of the Department. All new entrants to the Science Faculty have to participate in an orientation programme soon after joining the University. Students can get a clear idea of the course details by the handbook and other handouts distributed to them during this programme.

There is a group of student counselors in the Faculty appointed by the University who would help and assist with regard problems that they face as junior as well as senior students.

Orientation programme mentioned above help the students to adjust themselves to the new University environment through a series of events including talks, social and cultural activities and tours.

Reviewers think that Academic Guidance and Counseling of the Department is good.

#### **5. RECOMMENDATIONS**

Based on the findings indicated above we wish to make the following recommendations.

1. Reviewers are happy to see that Department is seriously trying to get the student feed back with regarding the teaching programmes. We recommend implementation of the proposed teacher and the course evaluation process soon.
2. Students have to sit for too many examinations and this may prevent them taking part in cultural, social activities and in sports. As such, it is recommended to look into the possibility of reducing “in course” examinations or at least make them less formal.
3. Reviewers believe that the “critical mass” of qualified staff needed to commence research degrees are now available at the Physics Department and therefore it is recommended to consider initiating such programmes. It is also recommended that necessary funds should be provided for this purpose and the library should be upgraded.

4. It was noted that almost all academic staff members are trained in Solid State Physics or in allied fields. This may even have some effect of the quality of the teaching programme. Therefore it is recommended to provide postgraduate training for probationary lecturers in other areas of Physics.
5. To further improve teaching and learning process it is recommended that better computer facilities be provided.

## 6. SUMMARY OF CONCLUSIONS

<b>Aspect reviewed</b>	<b>Judgement given</b>
Curriculum design, content and review	<b>Good</b>
Teaching learning and assessment methods	<b>Good</b>
Quality of students including student progress and achievements	<b>Good</b>
Extent and use of student feedback, qualitative and quantitative	<b>Satisfactory</b>
Postgraduate studies	<b>Good</b>
Peer observations	<b>Satisfactory</b>
Skills development	<b>Good</b>
Academic guidance and counselling	<b>Good</b>