**Higher Education for the Twenty-First Century (HETC) Project**

**Quality and Innovation Grant – (QIG)**
**Window 2 for Undergraduate Programmes**
**Round 2: Proposal Submission**

**Name of Study Programme:** Physical Science

**UGC Reference Number:** 13

**If the Study Program Received a IRQUE grant:** Yes

**Department(s):** Chemistry, Computer Science, Mathematics and Statistics, and Physics

**Faculty:** Science

**University:** University of Jaffna

**Name, Signature and Contact Details of Principal Proposal Writers:**


Dr. S. Arivalzahan
Department of Mathematics and Statistics
University of Jaffna
arivu90@gmail.com

Dr. P. Iyngaran
Department of Chemistry
University of Jaffna
piyngs@jfn.ac.lk

Mr. K. Thabotharan
Department of Computer Science
University of Jaffna
thabo@jfn.ac.lk


**Number of proposals submitted per Faculty:** One

**Signature and Seal of the Dean of the Faculty:**

**Signature and Seal of the Vice–Chancellor:**

**Date of Submission:** 01/01/2013

**Compulsory Appendices:**

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| Appendices 1.1, 1.2, 1.3<br>Appendices 2.1a, 2.1b, 2.2, 2.3, 2.4, 2.5 | |

# Executive Summary

The Physical Science Study programme at the Faculty of Science has a good track record for over four decades for its curriculum and the knowledgeable graduates it produces. Graduates of this study programme wait for a longer time to find the most suitable jobs for them and employers often complain that though the graduates are good in their subject knowledge, they lack many of the key characteristics that the world of work expects them to possess to be immediately employable. This lack has been partly due to the unsettled situation that prevailed in Northern Sri Lanka till mid 2009 and partly due to the lack of exposure of our graduates to the modern job market. This proposal tries to identify the gaps that exist between the current job market expectations and the skills and characteristics of the graduates and, proposes activities in multidimensional ways that introduce interdisciplinary courses to enhance knowledge in multiple fields, promotes career awareness, stimulates skill development and personality development among the students. Therefore the outcome of the study programme intends to satisfy the expectations of the global job market and to ultimately reach the goal of increasing the employability of graduates of this study programme.

Activities proposed here are prepared in collaboration with the stakeholders, the student community and the academia. Introducing interdisciplinary courses to increase the knowledge horizons of the students, improving interactive teaching and the learning environment, and improving career prospects are the broad topics of activities that are advanced in this proposal. Sub activities that further refine each of these activities have been proposed and prepared with a vision to uplift the skills and the level of knowledge of students to a certain acceptable level in order to fill the identified gaps. By evaluating the importance of each activity, the funds required for each activity have been carefully shared among different activities and expects to bring the required level of competency among the students. Performance indicators have been identified with observable base line values to ensure that the attainment of students in each dimension is measurable. Project monitoring bodies at the Faculty and University levels will be established to monitor and evaluate the project progress and the assistance of the HETC-OTS at the University of Jaffna will be obtained to handle the procurement of goods, services and works. Contingency plans have also been suggested to sustain the outcome of this proposal at the end of the project period.

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# Chapter 1: Background

The University of Jaffna was founded in 1974 as the Jaffna Campus of the University of Sri Lanka. Since then it has played a major role in promoting educational and cultural values of people in this region. The Jaffna Campus was started with only two faculties, the Faculty of Science and the Faculty of Humanities.

On first of January 1979, the Jaffna Campus of the University of Sri Lanka became an independent autonomous national university with the implementation of the Universities Act (number 16 of 1978) and was named the University of Jaffna, Sri Lanka. At present, the University has two main campuses, the original campus at Thirunelvely, Jaffna and the second at Vavuniya, with eight faculties spread over these two campuses. The present undergraduate student population is around 5257 and the postgraduate student population is around 855. The population comprises all three ethnic groups Sinhalese, Tamils and Muslims. The University receives the services of nearly 388 academic staff and 804 non-academic staff. The University of Jaffna is committed to the search for truth in a diverse field of subjects, as emphasized in its motto "Discernment is Wisdom".

The Vision of the University is to be a leading centre of excellence in teaching, learning, research and scholarship, and the Mission of the University is to produce intellectually and professionally competent and capable graduates to meet the emerging needs of the national and international community, with a special emphasis on the social, economical and cultural needs of Northern Sri Lanka.

The Faculty of Science is one of the first two faculties established at the inception of the University and there are seven academic departments in this faculty. The Vision of the Faculty is to be recognized as an eminent centre of science learning in Sri Lanka, and the Mission of the Faculty is to produce competent graduates who excel in learning and research in the basic sciences, and who could contribute to the development of the nation. The Faculty confers degrees for three study programmes. The Physical Science study programme was one of the first study programmes offered by the faculty and has a very good reputation among students and employers. Eminent professors of the University of Jaffna drafted the syllabi for this study programme, which from time to time have been revised in order to cater for the changing needs of the world, in consultation with experts from Western universities. The present student population of the study programme is around 350, the staff population is around 75 including academic support staff, clerical and minor employees [see Appendix B, Table 2.3].

The University of Jaffna is situated 400 km north of Colombo, and hence has access only to a few small industrial establishments because of the isolation from the rest of the country, and the warlike situation which prevailed in the region for the three decades. This makes it difficult for the study programme to develop effective university–industry linkages in learning and teaching processes. It is also a major drawback in developing research programmes relevant for national and regional development. However, graduates of the Physical Sciences study programme have good job opportunities, as there is a continuous demand for our graduates in the government and private sectors. Since the end of the war in 2009, an increasing number of students from all three ethnic groups have been admitted to the University of Jaffna for different courses of study and few departments in this study programme are now able to successfully make limited industrial links.

Professor K. Kandasamy, the Dean of the Faculty of Science, University of Jaffna, appointed three senior academics from different departments of the physical science study programme as coordinators for developing the proposal for the QIG window-2, round-2. The proposed coordinators Dr. S. Arivalzahan, Dr. P. Iyngaran and Mr. K. Thabotharan, who attended the workshop for "Proposal writers QIG window-2, round-2" conducted by the Director of the HETC Project on 20 November 2012 at Janaki Hotel, Colombo, then called for an academic gathering, which also included the senior technicians of the Science Faculty involved in the study programme. The proposal writers briefed the audience about the nature of the grant and the guidelines for the preparation of the proposal.

The Physical Science study programme was given a grant under the IRQUE-QEF project implemented over five years from 2006 to 2010 and the grant has been efficiently utilized for uplifting the educational process of the physical science study programme and student welfare. This has prevented us from applying for the QIG grant in window-2, round-1. The successful implementation of the IRQUE-QEF project has enhanced the Graduates' Average Students' Performance (ASP), reduced the number of failures and lowered the dropout rate, and enhanced English Language proficiency and ICT skills [see Appendix F]. In 2003, the graduate employability was 34.72% which increased to 45% in 2010 by the implementation of the IRQUE-QEF project. This excludes the 94.12% of observed employability in 2009 due to the graduate absorption in to the Government sector. Thus the student community, stakeholders and the nation as a whole have been benefited. Since the IRQUE project funding is over, the sustainability and improvement of the envisioned goals of the proposal is essential in order for our students to get the most appropriate jobs. In recent years the Physical Science study programme experienced a sudden increase in the number of students admitted to the study programme from all around Sri Lanka. For example, in 2010, the number of students admitted to the study programme was 80 whereas in 2011 this became 188. Thus, there is a need for increasing the resources of the study programme in order to provide a conducive environment to the students and the generous funding from the QIG is highly appreciated.

In the study programme, some subjects have restrictions in the number of students admitted to them and this creates dissatisfaction among students as many find that such restrictions prevent them from taking their preferred subject. There is a need to increase intake into such subject streams and the provision of needs requires further expansion of facilities. On a positive side, this increased intake of students to these subjects will increase the number of qualified graduates satisfying the national and global demands.

The University of Jaffna and the Faculty of Science are willing to provide the necessary commitment by means of personnel and other strategic issue assistance to propose and carry out this project. Many academic staff of this study programme have undergone rigorous and methodical training for proposal writing and managing of larger projects administratively and financially. The OTS office of the HETC project is managed by well qualified and able staff (a Director, a Deputy Director-Finance, a Deputy Director-Procurement, a management trainee on contract, and an office assistant on temporary basis). In the past when the IRQUE and other similar projects were implemented, the institute has made sufficient personnel, infrastructure and other logistic support. The Faculty of Science has satisfactory infrastructure in the way of buildings, lecture halls, laboratories and other related logistic facilities to carry out various project related activities. Many academic staff from the Faculty of Science have played major roles in these projects for example the posts of IRQUE project coordinator, director of LTS, and

some are still functioning as UDG coordinator, Quality Assurance and Accreditation Council Cell coordinator etc. The experience and knowledge acquired by these staff have been well communicated to the other staff members in this Faculty. The Faculty of Science of the University of Jaffna is one of the well established faculties in Sri Lanka and maintains a good track record in proposing, managing and sustaining such larger projects.

During the initial stage of structuring the comprehensive proposal, regular meetings were held at department level and collectively at the study programme level. Detailed discussions were done at department level with academics to get their feedback and suggestions. Similarly, discussions were held with the students at all levels of the study programme and their feedback was obtained through a questionnaire, to facilitate improvement of the quality of undergraduates and the relevance of the curriculum to meet strategic objectives of the study programme. A task force consisting of senior and junior staff members was appointed to collect data from the stakeholders needing the services of our graduates, to improve the physical science study programmes concerned in this proposal [see Appendix E]. Also task forces were entrusted to assemble various components of the proposals. Teams went in person to collect data from stakeholders including governmental and non-governmental organizations, banks, schools, industries, etc., where our science graduates are employed in major cities such as Jaffna, Point Pedro, and Kilinochchi of the Northern region.

The team also sent a questionnaire to stakeholders in the Southern region and received responses by email from stakeholders such as Sri Lanka Telecom, National Physical Laboratory, Sri Lanka Institute of Nano Technology, Virtusa, 99x Technologies etc. Furthermore, interviews with stakeholders were conducted over the phone by senior academics elected from departments offering physical science courses. In addition to the questionnaire, staff of the study programme were interviewed to express their views on the performance of our students and recent graduates. The proposal development team is backed by highly experienced senior staff who have successfully developed and implemented the IRQUE-QEF proposal.

A committee of senior academics in the Physical Science study programme carried out an analysis considering the available data and the background of the study programme. As a result of this analysis the strengths of, weaknesses of, threats to and opportunities to this study programme have been identified as follows:

The *strengths* of the study programme are:

1. A collection of sound core courses is offered.
2. Good evaluation process of core courses, especially all honours degree courses have external examiners from developed countries for moderation and second marking purpose.
3. In-course assessment marked answer scripts are returned to the students enabling them to evaluate their progress.
4. Since the inception, the study programme has good track record.
5. The study programme is unique in its nature.
6. Multi ethnic student population.
7. Gender balance among students.
8. All departments had solid foundations as the pioneering staff had high academic qualifications and experience.
9. All departments have good infrastructure facilities.

10. Majority of our senior academic staff are young Ph.D. holders with foreign exposure.
11. Good team work among the academic staff.
12. Staff members have won many grants and they hold many high positions in committees.

The *weaknesses* of the study programme are:

1. English language training provided by the university is not satisfactory
2. Supplementary courses offered are not job oriented.
3. Fewer choices in selecting supplementary courses.
4. Lack of interactive teaching-learning process.
5. Student counselling services are very much limited.
6. The University failed to provide proper career guidance.
7. Poor English language proficiency of students.
8. Lack of communication skills among the students.
9. Lack of teamwork among students.
10. Lack of motivation among students.
11. Students lack in independent learning.
12. Most students are day scholars, travelling from home due to non-residential facilities in the campus.
13. Disruption of normal learning activities due to long periods of ragging.
14. Lack of leadership skills among graduates.
15. Lack of self-confidence among graduates.
16. Graduates are not readily employable.
17. The teaching-learning environment is not satisfactory.
18. Lack of leisure facilities for students.
19. Unsatisfactory toilet facilities for students.
20. No hygienic drinking water available for students.
21. The library operates on a manual system and is not fully automated.
22. Lack of audiovisual facilities in the lecture theatres.
23. Lack of facilities for self-learning.
24. Insufficient modernised equipment available in the laboratories.
25. Lab equipment does not meet the present teaching needs to carry out experiments.
26. Examination results are released with long time delays.
27. Staff-student research is minimal.
28. Trilingual ability among staff is very poor.
29. Lack of staff participation in student-centred sports or cultural activities.
30. Lack of training for laboratory technicians.
31. Absence of personal student mentors/tutors.
32. No peer evaluation carried out for academic staff.

The *opportunities* to the study programme are:

1. There is a high demand for science teachers from our study programme, thus our graduates will have better job opportunities.
2. Worldwide demand for pure science graduates provides opportunities to our graduates in seeking employment globally.
3. Many external examiners are foreign academics and this gives international recognition to our graduates, which enables them to obtain scholarships for their higher education.
4. The demand for science graduates in the industry is also increasing and our graduates will have newer job opportunities. For example, Computer science graduates will be able to find good job opportunities in Software industry, Chemistry and Physics graduates will be able to find good job opportunities in diverse areas such as Household consumer products, Electronics industry and Agro chemicals, and Mathematics and Statistics graduates will be able to find jobs in the areas such as Pharmaceuticals, Insurance companies, Market research companies and Banks.
5. The government plans to make Sri Lanka the knowledge hub of Asia, thus our graduates will have good employment opportunities.
6. As the twenty first century is being described as the Asian Century, the economic boom in Asia provides good employment opportunities for our graduates.
7. After the end of war in 2009, Jaffna has re-established its links with the rest of the world and this has opened new doors for our graduates.
8. The present conducive environment will encourage student, staff exchange programmes.
9. New economic development activities are taking place in the region and this creates new opportunities.
10. Many alumni of the study programme working abroad are willing to extend academic/industrial assistance.
11. Many staff members have received their degrees from foreign countries and this enables them to establish international links.
12. Many young academics are actively participating in international and national level conferences, which encourage them to engage in scholarly discussions and establish research collaboration.

The *threats* to the study programme are:

1. Global trend of growing demand for professional graduates rather than graduates with pure science degrees.
2. Students with good performance in the G.C.E.(A/L) examination prefer to take professional courses. e.g., Engineering/IT/Law/CIMA.
3. Prospective new entrants' English proficiency is very weak.
4. Arrival of Foreign Universities and their affiliated colleges in Sri Lanka is a threat to both prospective students and staff members.
5. Inadequate fund allocation for the higher education in Sri Lanka.

6. Geographical location of the University from the capital minimizes opportunities.
7. The remuneration for the academic staff is not attractive.
8. Inability to recruit well qualified staff.
9. Global economic slowdown reduces academic scholarship opportunities.

The data analysis reveals that our graduates possess sound subject knowledge and are pretty good in carrying out their duties. But in general our graduates experience weaknesses in communication skills, inadequacy in English Language speaking ability, ICT skills, interpersonal skills, analytical skills, managerial skills and technical document preparation skills that prevent them from readily being employed. Our graduates have problems in finding their first job, but once they have been offered a post, they hardly face any hardships in securing their place. They truly impress their employers and rise up quickly through their hard work. Most of the graduates, in the past, were absorbed into the teaching profession which was not the sole objective of the study programme. One of the reasons for this is that the study programme failed to identify some of the attributes of the graduates required for their employability. Hence the relevance of the present study programme to identify job market needs improvement.

# Chapter 2: Concept and Justification of Proposal

## 2.1. Relevance of the Study Programme for the Job Market

The Physical Sciences include the branches of natural science and sciences that study non-living systems. The study programme in Physical Sciences offered by the Departments of Chemistry, Computer Science, Physics and Mathematics and Statistics open the eyes and minds of undergraduates to the physical world and the workplace that surrounds them, dealing in matter, energy, industrial processes, technology, optimization and quality control. The study programme prepares graduates for numerous respected professional careers such as chemists, physicists, environmental scientists, pharmacists, statisticians, assessors, quality controllers, system analysts, computer programmers, meteorologists, teachers, research scholars, geologists, etc. Traditionally the Physical Science degrees fall into Basic Science. In Sri Lanka, Basic Science graduates in addition to the above actuarial, scientific and industrial sectors, join, administrative, banking and educational services. Due to the emergence of interdisciplinary scientific development: Nanotechnology (Physics and Chemistry), Bioinformatics (Computer Science, Statistics and Biology), Data mining (Computer Science and Statistics), Climatology, Financial Mathematics and Actuaries (Finance, Mathematics and Statistics), Control Systems (Applied Mathematics and Electronics), Mechatronics (Applied Mathematics and Engineering), there is a high demand nationally and globally for interdisciplinary science graduates. At present our curriculum is more conventional and lacks interdisciplinary courses. This is the main drawback for graduate employment opportunities in the current employment areas of a disciplinary nature. Therefore the revamping curricula are pertinent.

A study carried out during 2000 to 2002 and 2003 to 2004 by the Science and Technology Research Division of the National Science Foundation of Sri Lanka revealed that the employment rate of B.Sc. general degree graduates has risen up from 57.4% to 66.6%. Survey carried out for this proposal among the recent graduates reveals that soon after the graduation almost all of the graduates are self-employed as private tutors for which there is a considerable demand in the middle-class metropolitan areas. In addition, the survey revealed that 13% of the recent graduates served in the Universities or Higher Educational Institutes as lecturers, demonstrators or tutors on contract basis and continued part-time postgraduate programmes, 29% of the graduates worked as high-school teachers, 50% are employed in public administration, 6% are employed in private sectors, and 2% are self employed (mostly private tutors and IT related businesses) [see Appendix C, Figure 1].

The survey revealed that the waiting time for the graduates to get their first steady job is around two to three years [see Appendix C, Figure 2] and the salary band is LKR 20,000 to 30,000 [see Appendix C, Figure 3]. This is partly due to delay in releasing the degree results by the University. Normally it takes six to nine months to release the degree results after the final examination. Most of the graduates lack the confidence to find jobs in industries and private job markets and await calls from the government for the recruitment of graduates. This is partly due to the following weaknesses of the study programme:

- Insufficient soft and transferrable skills
- Lack of exposure to the industrial environment
- Lack of interdisciplinary courses

Hence, we need intervention to enhance the relevance of the study programme to the job market.

## 2.2. Vision of the Graduate Profile

Stakeholders normally expect the following qualities when recruiting graduates:

- Sound knowledge in the relevant field,
- Good communication skills,
- Ability for team work,
- Good personality and leadership skills,
- Positive attitude in problem solving,
- Creativity and the ability to meet new challenges,
- Capability in using ICT facilities in their work, and
- Consciousness of the importance of peaceful coexistence in a multicultural society.

The graduate profile is formulated by taking into consideration the expectation of the stakeholders and other relevant aspects of the globalization. The desired performance of the graduates and the vision of the graduate profile of the study programme is as follows:

> To enable the graduates to enjoy global citizenship and pursue advanced learning and research relevant to national and global development, the study programme aims to offer comprehensive and balanced curricula that cover the full range of interests in the subject majors: Chemistry, Computer science, Mathematics, Physics and Statistics, supplemented by a well-rounded education. In addition, the graduates shall have the necessary soft skills: ICT skills, trilingual proficiency (English, Tamil and Sinhala), progressive development of transferable skills including: communication; critical and analytical thinking; problem solving; information handling; numerical skills for quantitative analysis; time management and prioritisation of work, ethical and social understanding to meet the stakeholders' expectations. The study programme seeks to provide the desired exposure with industries to enable graduates to be readily employable. With these attributes, the graduates should also be able to pursue lifelong learning to accept and adapt to the demands of ever evolving modern life challenges, especially those emerging from a changing technological environment. Further, the study programme aims to produce graduates who are conscious of their importance in building up a cohesive and socially harmonious nation.

## 2.3.Current Status of the Study Programme in Relation to Desired Graduate Profile

### 2.3.1. Curriculum

In addition to the facts mentioned in the relevance of the study programme, the Physical Science study programme has very special features. This study programme is the pioneering one in Sri Lanka, instituted in 1975 to offer a special degree in Statistics. In par with the changing world's employability needs the physical science study programme has adopted newer subject streams from time to time and at present is composed of a broad range of subjects Applied Mathematics, Chemistry, Computer Science, Physics, Pure Mathematics and Statistics.

The Twenty First century is being described as the Asian Century, and the economy of Sri Lanka in line with the other Asian countries is growing fast. Moreover, the government plans to make Sri Lanka the knowledge hub of Asia. Physical science graduates can contribute a lot in the prospective knowledge based industries of our country.

Recently all four departments participating in the study programme underwent a Quality Assurance subject review conducted by experts arranged by the Quality Assurance and Accreditation Council, Sri Lanka. With respect to the aspects reviewed the departments were judged well in Curriculum Design, Content and Review as well as Teaching, Learning and Assessment Methods, and limited in Counselling and Peer Evaluation.

At present the study programme is viewed as a means to impart basic knowledge related to the Physical Sciences. However the current curriculum is not outcome based, does not contain interdisciplinary courses to address modern trends and lacks industrial exposure. Because of this most of the graduates of the study programme are unable to readily find jobs in the industries and the private sector, and end up in government jobs, especially teaching in high schools (around 90% of our graduates are government employees [see Appendix C, Figure 4]).The study programme therefore has to be geared to make it outcome based and interdisciplinary based.

The curriculum of this study programme was initially developed during the period 1974 and 1975, in line with the Physical Science curriculum of other universities in Sri Lanka and the United Kingdom, by senior founder professors who had wider knowledge in their respective fields. Since then the curriculum and the structure of the degree programme have been revised to keep up with partial fulfilment of current needs and modern trends, subject to the limitations (such as depletion of staff, isolation from the rest of the country, lack of resources, etc.), created by the war-like situation that prevailed in the region for the last three decades.

Since the inception of the Faculty of Science the curriculum of the science degree programmes has been re-structured four times. At the beginning the Faculty adapted the year-end examination system (1974/ 75), then semester-based system (1984/85) followed by the course unit semester-based system (1992/93) and now modularized credit valued, semester based course unit system (since 2003/04). The present structure of the degree programme is designed to fall in line with the recent reforms introduced by the Standing Committee for Science of the university Grants Commission (UGC). However, the present curriculum is nearly ten years old and it needs revision.

The structure of the degree programme clearly specifies the number of credits required to earn a degree and also the number of required credits for each year. A credit is assigned to course units on the basis of the number of contact hours. Fifteen hours of lectures and tutorials or 15 practical sessions of laboratory work amount to one credit. The minimum credit requirements for a three year degree shall be 90. Students of the Physical Science programme have to choose three principal subjects (amounts to 24 credits) in their first year of study and from the second year onwards they can either continue with their three principal subjects or choose two principal subjects (amounts to 24 credits: $3\times8$ or $2\times12$) leaving out the third subject that they followed in the first year.

The departments offering the principal subjects provide course units in two categories namely Core courses and Elective courses. The core courses which are considered the essential base of the subject are compulsory courses. The elective courses which are course units outside the core courses can be chosen by the students according to their preference.

In addition to these main subject-related courses, there are certain courses classified under categories such as Auxiliary courses and Enhancement courses. These course units are designed to provide basic knowledge on a wider range of disciplines that an undergraduate should possess in the present era. The Auxiliary course units are treated as non-credit valued course units as they are not taken for the computation of the GPA. The Enhancement course units are credit valued and are taken for the computation of the GPA. However all the auxiliary course units shall be evaluated and considered for the award of degree.

The Faculty offers courses in many supplementary subject areas depending on the availability of resources, and the courses offered may change from time to time. However, there is a limited flexibility for the students to select courses offered in Supplementary courses to meet the required credits for each year. There is a window in the structure of the degree programme for students to take courses from other Faculties to earn their required number of credits. However the first year students cannot take Supplementary or Interfaculty courses and they have to take all Core courses in the three principal subjects and other Auxiliary or Enhancement courses.

The curriculum of the study programme is also designed to fit into the structure of the science degree programme. Courses offered in the study programme have wider coverage with detailed description of objectives, syllabi and evaluation methods. It should be admitted that the courses offered in the study programme can be further strengthened with inputs from stakeholders as recommended in the Subject review reports.

All the four year Degree programmes (amounts to 120 credits) have research project components of four to six credits. However, three year General Degree programme (amounts to 90 credits) does not have any research project component.

Well structured questionnaire was given out to the students and graduates of the Physical Science study programme. 58 students and 103 graduates have participated in this survey. The less number of student participation was due to the unavoidable circumstances in the university premises. Among those 70% of the students and 67% of the graduates think that Supplementary course units are not a positive side of their university education [see Appendix C, Figures 5 & 6]. It should be admitted that the current Supplementary courses are not interdisciplinary courses and they are not job-oriented as well. 59% of the graduates think that enough choices were not given for their Supplementary courses [see Appendix C, Figure 7]. 83% of the students prefer to have scientific computing based practical [see Appendix C, Figure 8]. 53% of the graduates suggest that through personality development activities, a student's time at the university could be made more useful [see Appendix C, Figure 9].

With the view of the above discussion, the identified shortcomings of the curriculum aspects of the study programme are as follows:

- The present curriculum needs revision as the structure of the Degree programme is nearly ten years old.
- The present curriculum is not outcome based.
- Supplementary courses are not job-oriented.
- Limited number of supplementary courses.
- Absence of interdisciplinary courses.
- No research component in the three year general degree programme.

### 2.3.2. Teaching, Learning and Assessment

Even though the objectives of the course units are clearly mentioned in the student hand book, the intended learning outcomes are not clearly spelt out. At present the teaching-learning process is basically teacher-centred although student-centred learning is practised to some extent. Most of the teaching is facilitated with chalk and board. The use of ICT has been adopted in courses gradually, however most of the time the ICT usage becomes limited due to the cost of the equipment, technology and skills of the staff. Teaching is also supported to some extend by handouts and it varies from teacher to teacher and course units to course unit. Students' learning is mainly confined to lecture halls and laboratories. Tutorial assignments are given to understand the topics broadly and deeply, and to enhance their learning skills with the utilization of the Library. During the previous curriculum revision, experts' views were sought to modify the contents of the syllabi of the course units; few number of employers, alumni and students were consulted. It should be admitted that the present study programme is not designed as an outcome based or interdisciplinary based. Moreover interactive teaching-learning approach is not yet facilitated.

Attendance of teachers at lectures and the number of contact hours of a course unit are monitored by attendance sheets that are used to record the attendance of students for each lecture. The departmental secretary compiles the students' attendance for each course unit. Eighty percent attendance is mandatory in order to sit for the examination. Under the GPA system, in-course assessment carries 30% towards the final grade or result, with the end of course examination carrying 70% towards the final grade. The student evaluation process is very rigorous. Two examiners are appointed from the senior staff for the evaluation of each course unit offered. The "First Examiner" is in charge of the course and sets the examination papers. The "Second Examiner" moderates the paper and scrutinizes the answer scripts marked by the first examiner. Students expect feedbacks and grades as soon as the assessments are finished, especially during the formative assessments. However, present traditional evaluation methods take lot of time. Though frequent assessments might increase the student performance, sometimes the teachers are not willing to do it, due to the larger student population. The current traditional evaluation process does include group projects and presentations in few departments. Thus, the current evaluation process would not help the students to develop leadership skills, communication skills and team working.

Peer evaluation on the teaching process is yet to commence. There is no effective mechanism to evaluate teaching-learning processes except student feedback. Internal mechanisms do not require the departments and lecturers to produce self-assessment reports, teaching portfolios. Intervention is needed to improve internal management and quality assurance. 55% of the students who have participated in the survey think that effective teaching and learning process is not a positive side of their University education [see Appendix C, Figure 5]. Moreover, 60% of the students prefer to have web-based teaching components in their study programme [see Appendix C, Figure 8]. 44% of the graduates suggest that through interactive learning a student's time at the university could be made more useful [see Appendix C, Figure 9]. 88% of the students said that their English language ability could be enhanced through different evaluation processes [see Appendix C, Figure 10]. 69% of the students suggest that their English language ability could be enhanced through interactive teaching [see Appendix C, Figure 10]. 95% of the students suggest that the small group tutorial discussions would be more effective [see Appendix C, Figure 11].

The University English Language Teaching Centre (ELTC) is responsible for teaching compulsory Auxiliary English courses. It should be admitted that English language teaching is not at a satisfactory level. 78% of the students are not satisfied with the ELTC's speaking component and 62% are not satisfied with the ELTC's listening component [see Appendix C, Figure 12]. 68% of our graduates feel that their language skill needs to be developed [see Appendix C, Figure 13]. 62% of the graduates said that they had communication barriers in obtaining suitable employment [see Appendix C, Figure 14]. 70% of the graduates suggest that communication skills need to be developed during the undergraduate programme [see Appendix C, Figure 13]. The feedback of the employers shows that graduates are lacking in English proficiency and transferable soft skills including communication, teamwork, independent learning, interpersonal skills and leadership [see Appendix C, Figures 22 & 23].

In addition to the survey of stakeholders and graduates, a couple of focus group meetings were conducted among the academic staff to identify the weaknesses and strengths of the study programme. The following weaknesses were notified in these fora: examination results are released with great time delay, the library operates on a manual system and is not fully automated and disruption of normal learning activities results from long periods of ragging of fresher.

With the aid of the discussions above, we identified shortcomings of the teaching, learning and assessment processes of the study programme are as follows:

- Teaching of compulsory Auxiliary English courses by the ELTC is not innovative.
- Absence of group activities in the class room
- Lack of interactive teaching, learning and e-learning which causes deficiency in soft skills or transferable skills.
- Lack of opportunity to develop sufficient soft skills through the teaching-learning processes.
- Self learning through assessment is not at a satisfactory level.

### 2.3.3. Counselling and Guidance

The University has a counselling service to guide and assist the students to resolve their academic and personal problems respectively. The Vice Chancellor appoints a Senior Student Counsellor and Student Counsellors from among the Academic staff. The Faculty appoints academic advisors for each subject of the study programme from among the senior academics. However, it should be admitted that student counselling is limited. Moreover personal student mentors or tutors are not available in the Faculty. 83% of the students suggest that counselling programme would help them to perform better and 65% of the graduates said that counselling programmes would have helped them to perform better [see Appendix C, Figures 15 & 16]. 57% of the students think that lack of self motivation is a difficulty that they face in setting up their career goals [see Appendix C, Figure 17]. Focus group discussions among the Academic staff have also revealed that motivation in the study programme, self-confidence, leadership skills and team working are lacking among our students.

It should be admitted that the University has failed to provide proper career guidance. Only 23.3% of the graduates said that University's career guidance program helped them to achieve

their career goal [see Appendix C, Figure 18]. 79% of our graduates said they encountered difficulties in finding employment and 67% of the graduates think that they did not get their dream job [see Appendix C, Figures 19 & 20]. While 90% of the graduates are government employees, only 6.8% of our graduates said they have applied for jobs at NGOs or Industries [see Appendix C, Figures 1 & 4].

Students said that the following actions need to be taken to make them aware of future career prospects: Job search support (76%), Interview preparation support (67%), Career guidance workshops (67%) and on campus graduate recruitment interviews (57%) [see Appendix C, Figure 24]. Graduates suggest that the following would enable current students to be better informed: Career guidance workshops (70%) and prospective career information since first year (55%) [see Appendix C, Figure 21]. 66% of the students suggest that industrial internships will enhance their English language abilities [see Appendix C, Figure 10].

With the aid of the above discussion shortcomings in relation to the Counselling and Guidance are as follows:

- Student counselling service is very much limited in the University.
- Absence of personal student mentors or tutors in the Faculty.
- The University has failed to provide proper career guidance.
- Poor attitude towards team work due to lack of guidance.
- Lack of motivation among students due to lack of mentor programme.

### 2.3.4. Physical Resources

Departments of Mathematics and Statistics, Physics and Chemistry, which were established in 1974/75, had good infrastructure development during the first ten years till 1985. Since 1985, the conflict between Tamil rebels and the government forces intensified. Since then no major development in the physical facilities was carried out. In this regard, the Department of Computer Science, which was established in 1991, has no building of its own and is occupying the ground floor of the building of the Department of Mathematics and Statistics. Information about the physical resources available for the study programme can be found in Table 2.5.

The Department of Mathematics and Statistics has two large lecture theatres, M1 and M2 and they can accommodate around 300 and 150 students respectively. The lecture halls have the facility for chalk and board based teaching and need to be fixed with modern audio visual equipment when a lecturer needs it for his or her teaching. Moreover, the Department has two tutorial rooms and these two tutorial rooms are inadequate to conduct small group tutorial discussions in parallel. The Department has a small computer laboratory, which was established in 2008 under the IRQUE-QEF project with less than 30 computers. The above laboratory is inadequate to conduct practical classes for Statistics and Applied mathematics. The Department also has a small library with books mainly obtained from donations.

The Department of Computer Science does not have a single lecture theatre of its own. The main laboratory can accommodate around 40 students. There are three small laboratories available in the Department, but none of them can accommodate more than 20 students. Due to the lack of staff rooms, some of the academic staff occupy partitioned rooms, and student enrolment to Computer Science is restricted to eighty in an admission year due to the limited infrastructure facility and shortage of staff.

The Department of Physics has two lecture theatres: the main lecture theatre can accommodate 100 to 150 students and the other one can accommodate 30 to 50 students. The lecture halls have the facility for chalk and board based teaching and lack audio visual equipment. Moreover, the Department has two tutorial rooms. These two tutorial rooms are inadequate to conduct parallel small group tutorials. These four rooms are shared by all the other departments in the Faculty of Science except the Department of Chemistry. The Department has one seminar room equipped with audio-visual facilities. Physics department has two general laboratories and three advanced laboratories.

The Department of Chemistry has two large lecture theatres, C1 and C2, and can accommodate 250 and 100 students, respectively. Lecture halls, like other lecture halls in the faculty lack audio-visual equipment. Moreover, the Department has three tutorial rooms. The department is equipped with four general laboratories and three special laboratories. The large library room in the Chemistry Department can accommodate 50 readers at a time.

Though Physical Sciences have sufficient number of lecture halls, except Mathematics lecture halls M1 and M2, most of the lecture halls have theatre style and fixed seating arrangements. None of the lecture halls is equipped with sufficient audio-visual facilities, while students in private universities, foreign universities and even some schools benefit from the latest technological advancements in teaching.

66% of the students who participated in the survey think that the equipment available in the laboratories is not sufficient and suitable to carry out experiments. The focus group discussions among the academic staff revealed the following weaknesses: Lack of facilities for self learning, the teaching-learning environment is not tidy, lacks audio visual facilities in the lecture theatres and the existing ones are not working properly, lack of leisure facilities for students, no toilet facilities for students, no hygienic drinking water available for students and staff. It has also been observed that in the recent years the student intake continues to increase, where as the annual allocation continues to shrink. In order to cater to the needs of an increasing student population, procurement of laboratory equipment is not sufficient.

The university hostels (which have less than 600 beds) do not have sufficient accommodation facilities, thus most of the students are day scholars. Students always tend to go home soon after the lectures, which discourages these students from participating in sports and other extracurricular activities in after hours. This indeed contributes to the lack of personality development. The lack of leisure facilities in the university environment is discouraging the students and not letting them spend quality time in the university. Even the basic facilities such as toilets, hygienic drinking water, leisure places, stone seats, cafeteria, and sports complex are lacking. Places for collaborative studies other than lecture halls are lacking. Further, pictures of private universities and universities in abroad set the expectation of students high in this regard.

The comforts and facilities provided to academic staff are also not up to the expectation. This prevents staff from actively engaging in research activities. Under the SIDA Network project all the four Departments were provided with Internet and all senior lecturers are provided with personal computers with Internet connection for their academic and research purposes. During the normal working time surfing in the Internet is slow due to low bandwidth connectivity. A much higher capacity broadband connectivity is preferred.

Library facility is an important factor that constitutes self-learning, motivation and research. However, since the library facilities are not fully automated, the students have difficulties in identifying right reference books for borrowing and reading. Further, library lacks e-library connectivity, which causes difficulty for the students and staff in their research activities.

In view of the above discussion the identified shortcomings in the physical resources are as follows:

- The teaching-learning environment is not tidy.
- Lack of leisure facilities for students.
- Not enough toilet facilities for students.
- No hygienic drinking water available for students.
- The library operates on a manual system and not fully automated.
- Lack of e-library connectivity.
- Lack of audio-visual facilities in the lecture theatres.
- Lack of facilities for self-learning.
- Insufficient equipment available in the laboratories.
- Lab equipment does not meet the present teaching needs to carry out experiments.

### 2.3.5. Staff

The departments involved in offering the study programme are sufficiently staffed to conduct lectures. Most of the staff are young, energetic and motivated. More than 82% of the staff are under the age of 45. Nearly 85% of the senior staff are Ph.D. holders with foreign exposure and are capable of running the study programme successfully. Nearly 22 % of the Academic staff are females [see Table 2.4].

In the Department of Mathematics and Statistics out of 18 academics eight are senior lecturers, one of the latter a professor and another, an associate professor. In the Department of Computer Science out of six academics four are senior lecturers. In the Department of Physics out of 10 academics four are senior lecturers, one of the latter a senior professor and another, two professors. In the Department of Chemistry out of 13 academics 10 are senior lecturers.

Most of the academics are involved in research activities. All the Departments offer special degree programmes and most of the senior academics guide special degree students in their research projects. Apart from this, individual staff members have obtained research grants from national agencies such as the National Science Foundation (NSF) and National Research Council (NRC) for various research activities. These grants have resulted in upgrading or establishing laboratories in the departments, relevant to their research activity.

Research publications by academic staff vary individually and departmentally. Although the academic staff face difficulties and logistic problems, a considerable number of research articles have been published by academics attached to the four departments. A considerable number of articles are also published in indexed international journals.

It should be admitted that vast majority of the staff members' Sinhala language proficiency is poor and 26% of the undergraduates are Sinhalese. The focus group discussions revealed that staff participation in student centred cultural activities is minimal.

It should be admitted that there is a severe shortage for non-academic staff. At present none of the departments has a clerk and except for the Department of Mathematics and Statistics all other departments have a computer applications assistant. At present, the Department of Mathematics and Statistics has only one non-academic staff. Among the 10 available technical officers one is attached to the Department of Computer Science, three are attached to the Department of Physics and six are attached to the Department of Chemistry. The focus group discussions revealed that training for the laboratory technicians is not sufficient. Although there are approved non-academic cadres in the Faculty, they are still vacant and the search continues for qualified persons. However, currently non-academic staff vacancies are being filled by political appointments, which is unfavourable for maintaining the quality of the personnel.

With the view of the above discussion the identified shortcomings of the staff are as follows:

- Trilingual ability among staff is very poor.
- Lack of staff participation in student centred sports or cultural activities.
- Lack of training for laboratory technicians.
- Political appointment of non-academic staff.

### 2.3.6. Grand Summary of Shortcomings

Aforementioned discussions under the topics of curriculum structure, teaching, learning process, counselling and guidance, physical resources and staff the identified shortcomings of the respective aspects were elucidated. The Grand Summary of compiled shortcomings of the study programme is given below.

- Teaching of Compulsory Auxiliary English courses by the ELTC is not innovative.
- Absence of group activities in the class room
- Lack of interactive teaching, learning and e-Learning which causes deficiency in soft skills or transferable skills.
- Lack of opportunity to develop sufficient soft skills through the educational process.
- Self-learning through assessment is not at a satisfactory level.
- Absence of group activities in the class room.
- Student counselling service is very much limited.
- Absence of personal student mentors/tutors.
- The University failed to provide proper career guidance to the undergraduates.
- Lack of motivation among students.
- Students lack in independent learning.
- The teaching-learning environment is not tidy.
- Lack of leisure facilities for students.
- Lack of toilet facilities for students.
- No hygienic drinking water available for students.
- The library operates on manual system and not fully automated.
- Lack of audiovisual facilities in the lecture theatres.
- Lack of facilities for self-learning.
- Insufficient equipment available in the laboratories to cater the growing number of students.
- Lab equipment does not meet the present teaching needs to carry out experiments.

- Trilingual ability among staff is very poor.
- Lack of staff participation in student centred sports or cultural activities.
- Lack of training for laboratory technicians.

### 2.3.7. Gap Analysis and Justification of Proposed Activities

Listed shortcoming on the present status of the study programme clearly reveals a number of identified gaps between the desired graduate profile and the present performance of the graduates.

Revealed identified gaps are:

- Lack of English language proficiency
- Lack of communication skills
- Lack of leadership skills
- Lack of self confidence
- Lack of motivation
- Lack of self-learning
- Lack of trilingual proficiency
- Lack of application oriented exposure
- Lack of industrial exposure
- Lack of interdisciplinary knowledge
- Lack of awareness in career prospects
- Inadequate positive attitude towards lifelong learning
- Lack of research exposure
- Lack of independent learning
- Lack of critical thinking
- Lack of problem solving skills
- Lack of ethical and social understanding
- Lack of ability to adopt to modern and new technical environment
- Lack of awareness in the modern trend of the subject areas
- Lack of team work
- Most students are day scholars
- Lack of leisure facilities and corroborative environment for students.
- Lack of basic facilities including toilet facilities, unhygienic drinking water.
- Lack of interactive learning support facilities in lecture halls.
- Lack of teacher–student interaction.
- Disruption of normal learning activities due to prolonged ragging activities and other unforeseen situations.
- Lack of library automation and facility for research support.
- Lack of career guidance.
- Lack of industrial links

The gaps borne out of the present status of the curriculum are lack of English language proficiency, lack of trilingual proficiency, lack of interdisciplinary knowledge, lack of awareness in modern trends of the subjects, lack of ability to adopt modern technical environment and lack of team work. To narrow down these gaps an activity entitled **"Revamping curriculum to improve employability"** is proposed.

The gaps borne out of the present teaching and learning process are lack of communication skills, lack of leadership, lack of self confidence, lack of independent learning, lack of critical thinking and lack of problem solving skills. To narrow down these gaps an activity entitled **"Facilitating interactive teaching and learning processes"** is proposed.

The gaps borne out of the present career guidance and counselling setup are lack of industrial exposure, lack of awareness in career prospects, inadequate positive attitude towards lifelong learning, lack of research exposure, lack of ethical and social understanding. To narrow down these gaps an activity entitled **"Improving career prospects"** is proposed.

### 2.4. Innovativeness and creativity of proposed activities

- Activity 1: Revamping curriculum to improve employability

Innovative features of this activity are to design and incorporate courses of modern interdisciplinary nature to enable the graduates to compete in the growing modern employment sectors such as: Nanotechnology, Actuarial Sciences, Data Mining, Social Network Analysis, Financial Mathematics etc. Creative features of this activity are to facilitate research components in the B.Sc. general degree curriculum and to incorporate appropriate assessment methods to improve soft skills and self learning.

Sub activities of this activity are:

- Incorporating interdisciplinary courses
- Introducing job-oriented projects and assignments

- Activity 2: Facilitating interactive teaching and learning processes

Innovative features of this activity are to focus on improving the necessary soft skills for the Twenty First century among the graduates through the provision of a rich learning environment to compete in the global job market. The creative feature is to facilitate a blended learning environment by introducing e-Learning in addition to traditional teaching and learning practices, which indeed contribute to self learning and lifelong learning attributes of the graduates.

Sub activities of this proposed activity are:

- Improving learning environment
- Providing e-Learning facilities

➢ Activity 3: Improving career prospects

Innovative features of this activity are to stimulate our students to set up a clear career goal, become aware of career opportunities and develop multidimensional personality skills, which will enhance motivation in the study programme. Creative features of this activity are to introduce a web-based modules which will bring the students, academics and stakeholders much closer in sharing knowledge and expertise in expanding students' horizons in building career paths and encouraging students with self assessment; facilitating mock interviews; and facilitating joint project supervision both involving academia and industry. This activity will have a significant impact on our graduates to contribute in the development of the nation.

Sub activities of this activity are:

- Enhancing student-stakeholder links
- Enhancing career guidance and counselling facilities

# Chapter 3: Innovative Features

## 3.1. Revamping curriculum to improve employability

### 3.1.1. Background and Rationale

Curriculum is the delivery vehicle of the objectives of the study programme. So the curriculum must have a sound design and structure to meet the aspirations of the students and parents, expectations of the stakeholders and relevance to the national development. In the new millennium, due to globalization and converging interdisciplinary nature of academic development, graduates should be more competent than ever before to have a successful career. The key areas of competence sought include digital ability, wisdom of initiative and entrepreneurship, transversal, cross cutting skills (problem solving, analytical, communication, and self-management), innovativeness and creativity. An Interdisciplinary study is to synthesize broad perspectives, knowledge, skills, interconnections, and epistemology in an educational setting. Several employers seek employees with interdisciplinary backgrounds and far-reaching knowledge bases. This hype and hope of interdisciplinary studies prepares the graduates to meet the demands of today's competitive working world. Several universities in the developed countries offer the opportunity to their students to study interdisciplinary courses.

As partially discussed in Chapter-2 studies involving stakeholders, alumni and students revealed that the present curriculum has number of shortcomings with respect to the relevance to national development and to be competitive in a rapidly evolving job market. Since 2004, with the introduction of semester based modularized credit valued structure of the degree programme, learning content and assessment method of the courses are gradually adopted. IRQUE-QEF grant facilitated to obtain expert consultancy to improve curriculum in Chemistry, Mathematics, Physics and Statistics.

Qualitative Assurance Council conducted subject review during 2005-2009. Recommendations obtained from the IRQUE consultants and the subject reviewers are slowly implemented due to the constraints faced by the war; isolation, and lack of resources.

A survey through structured questionnaire among the recent graduates of the study programme was conducted to obtain information on various aspects of the degree programme offered that contributes to employability, career development and relevance.

The present curriculum lacks interdisciplinary course units. This prevents students from enhancing their knowledge in the areas other than their principal subjects. So, intervention is needed to bring flexibility in the curriculum and to facilitate more interdisciplinary course units of an interdisciplinary nature. A survey among stakeholders was conducted to obtain information on the immediate employability and suitability of the graduates, employers participated in this survey. Survey revealed that our graduates lack industrial practice skills in applications, exposure on soft skills and English language proficiency.

Hence, in relation to the desired performance of the graduates, gaps borne out of the present curriculum are:

- Graduates lack awareness in the modern trend of the subject areas
- Graduates have limited ability to adopt changing technical environment

- Graduates lack interdisciplinary knowledge to compete in the emerging global job market in interdisciplinary areas
- Graduates lack trilingual proficiency which limits their contribution to national unity
- Graduates lack self-learning interpersonal and soft skills due to conventional assessment methods and absence of research components
- Graduate lacks application oriented exposure

To narrow down the gaps or identified problems the following solutions are proposed in this activity "revamping the curricula to improve employability" as an intervention from the QIG.

- Updating the curriculum in keeping with modern trends.
- Designing and introducing modern interdisciplinary courses.
- Incorporating industry oriented applied courses.
- Improving assessment methods to gear real-life problem solving skills.
- Introducing research components in the General degree programme.

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### 3.1.2. Objectives

- Improve knowledge in modern interdisciplinary areas.
- Develop the working ability with industries.
- Improve real-life problem solving skills.
- Conduct applied research.
- Know the current trends in the subject areas.

### 3.1.3. Innovative specificity

Convergence of different disciplines and the emergence of interdisciplinary courses/programmes are prominently visible in the scientific and technologic developments of the millennium. And this new trend is considered essential to tackle the present real-world problems of a complex nature: climate change, uncertainty of financial markets, energy crisis, digital and communication security, etc. As a new adventure, introducing interdisciplinary courses in the study programme is challenging and innovative and demands unusual collective effort among staff of different disciplines.

## 3.2. Facilitating interactive teaching and learning processes

### 3.2.1. Background and Rationale

Teaching and providing learning experience are the core elements of any study programme that produces graduates as envisioned. Qualifications of teacher, pedagogy, learning content and delivery, in class activities, assessment methods, formal/social interactions among learner and teacher, physical and mental stability of the learners and teachers, lecture rooms, basic facilities and comforts provided by university, accommodation of learner and teacher are some key factors that contribute to the success of teaching and successful delivery of learning experience.

End of the war in 2009 enabled more university-industry linkage, at this juncture more students tend to join industry soon after the graduation and many have joined industry in recent years. The feedback of the employers shows that graduates are lacking in English proficiency and transferable soft skills including communication, team work, independent learning, interpersonal skills and leadership.

The recent developments in web technologies, specially the social networks have attracted students. Students tend to spend more time on the web and they are comfortable with virtual collaborations. In addition, the availability of portable connecting devices are facilitating them connect to the Internet from their place of stay. Further, several well known educational institutions are delivering e-Learning on topics similar to those which have been taught in the physical sciences. The e-Learning facilitates self-paced learning while encouraging students to become life-long learners. Further, this new mode of delivery makes the distance an inconsiderable factor and enables experts who are in foreign countries to interact with learners/teachers.

The use of ICT has been acquired in courses gradually, however most of the time the ICT usage becomes limited due to the cost of the equipment, technology and skills of the staff. Students expect feedbacks and grades as soon as the assessments are finished, especially in formative assessments. However, present traditional evaluation methods take lot of time. Sometimes the teachers are not willing to do frequent assessments, though it might increase the student performance, due to large student population. On the other hand, nowadays several online certification exams are available and most of those exams give feedback soon after the examination. Providing handouts to students will improve self-learning and they will become active learners in class rooms. However, the facilities for providing handouts are limited.

The most of the students are day scholars. Students always tend to go home soon after the lectures. The lack of facilities in the university environment is not motivating students to spend more time in university. Even basic facilities such as toilets, hygienic drinking water and other important facilities such as leisure places, cafeterias, and a sports complex are lacking. Places for collaborative studies other than lecture halls are lacking. Further, pictures of private universities and universities abroad set the expectation of students high in this regard.

The infrastructure, comforts and other facilities provided to the academic staff are also not up to the expectation. Because of that sometimes staff are not willing take any challenges to improve the present system.

Though Physical Sciences have a sufficient number of lecture halls, most of the lecture halls have theatre style, fixed seating arrangements and not permitting for small group activities. None of the lecture halls is equipped with sufficient audio-visual facilities; still some of them have chalk and board while students in private universities, foreign universities and even some schools benefited by smart boards.

Library facilitation is an important factor that contributes to self learning, motivation and research. However, it is lacking. Since it is not fully automated, students have difficulties in borrowing and reading books. Further, owing to the rigid rules and practices followed, research students and staff have difficulty in getting journals and other scholarly materials.
Based on the SWOT-analysis and vision of the graduate profile the following gaps have been identified related to the teaching and learning process.

- Lack of transferable soft skills including communication skills, teamwork, leadership skill, motivation, self-confidence and independence.
- Lack of self learning.
- Lack of leisure facilities and corroborative environment for students.
- Lack of basic facilities including toilet facilities, unhygienic drinking water.
- Most of the students are day scholars.
- Lack of interactive learning support facilities in lecture halls.
- Lack of teacher–student interaction.
- Disruption of normal learning activities due to prolonged ragging activities and other unforeseen situations.
- Lack of library automation and facility for research support.

The proposed revamping tries to enable graduates to enjoy global citizenship and pursue advanced learning and research relevant to the national and global development through improving interactive teaching and learning. Revamping the learning environment according to the present proposed, facilitating atmosphere for students and staff, improving soft skills and providing e-Learning for physical science study programmes will make teaching and learning interactive.

To narrow down the gaps or identified problems the following solutions are proposed in this activity entitled "Interactive teaching and learning" as intervention from the QIG:

- Improve the facilities of the learning environment and departments to create interactivity through which transferable soft skills will be uplifted.
- Implementation of e-Learning facility and training students in e-Learning systems to motivate life-long learning and self-paced learning even during unpleasant situations in their university premises. The day scholars and students with lack of language proficiency can also benefit from the e-Learning facility.
- Strengthen the library with e-resources and e-books related to the physical science stream to encourage self-learning and research skills.
- Improve the corroborative environment for students and staff by providing basic facilities such as good toilets, hygienic water and leisure facilities that attract students to spend more time in the university premises, which will help to develop the soft skills.
- Strengthen the capacity of staff in modern teaching and learning processes and facilitate them to carry out interactive teaching and provide new learning experience.
- Build up the informal/social interaction among students and staff through informal activities such as games, outing and dining through which interactive teaching and learning, ethnic cohesion and soft skills shall be improved.

### 3.2.2. Objectives

- Develop transferable soft skills.
- Improve self learning.
- Increase collaborative and corroborative learning.
- Enable effective learning.

Targeted beneficiaries of this activity are the students and direct beneficiaries are industries, governmental and non-governmental organizations, and private sectors. The university, the region, the nation and the world will be the indirect beneficiaries.

### 3.2.3. Innovative specificity

The actions proposed in this activity mainly focus on improving the skills of students naturally through improvisation in the learning environment. In this activity objectives are achieved through implicit actions, the result is not business as usual as typical of other projects. These implicit actions will lead to a successful outcome, since students naturally improve skills without realization. The activity has training components to train stakeholders to adapt to the proposed environment; however, it will not target developing skills of stakeholders directly.

## 3.3. Improving career prospects

### 3.3.1. Background and Rationale

The SWOT analysis revealed that though the graduates possess high calibre, immediate employment opportunity is still not possible. Graduates also lack the opportunity to apply knowledge, skills and attitudes acquired from their study programme to a real professional setup and fail to map the relationship between their studies and future career options. In order to provide an effective entry route to the professional job market, we find that the curriculum should incorporate exposure to the industry expectations and the real life challenges. In the western world it has frequently been said that many students find their first employment where they had undergone some sort of internship. Many prospective students of this study programme have no career goal because of not entering to their dream study programme (e.g. Engineering, Architect, etc.) which has bad influence on them. In addition, the family background of the students also hinders them from setting up a career goal. Hence, for the students to be more focused on their career goals and objectives, the present study programme should provide counselling and career guidance.

The Physical Science study programme was unable to provide industrial exposure to the students due to the unsettled conditions prevailing in the northern region until 2009. However few departments in the study programme were able to make limited industrial visits after 2009. It has been noted that industrial visits expose the students to the state-of-the-art technologies, modern equipment, infrastructure facilities and team working in an industrial setup. These industrial visits will provide awareness to the students on job opportunities which will motivate them to be more focused in their studies. Further, such visits will urge students to develop their skills in multidimensional aspects.

The curriculum of the study programme did not have room to conduct trade fairs and bureaucratic barriers prevented stakeholders from organizing such events in the past. It has been revealed from the survey carried out among the graduates that trade fairs provide an opportunity to students and graduates to meet multiple stakeholders under one roof at the same time and exchange resumes and career prospects. Compared to industrial visits larger number of students get an opportunity to get to know many stakeholders and they are free to move around between stalls to establish industrial links. It is a more efficient and cost effective mechanism to introduce job markets among students and graduates. Industries can also benefit from trade fairs by popularizing their enterprise and identifying potential candidates.

Conducting workshops, seminars and tech talks are not part of the existing curriculum. Such gatherings will provide an opportunity to students to be more focused on the skills and knowledge development in concurrence with their curriculum. Experts will give hands on advice with modern technology for knowledge improvement, motivate students to express their ideas and encourage them to work in teams. Stakeholders will be able to meet targeted group of students in a confined environment and will be able to disseminate their expertise acquired over the years.

The present three year general degree study programme lacks research-oriented projects incorporating industrial joint supervision. In general, student projects are aimed at bringing out their problem solving skills inclusive of critical and analytical thinking, referencing, expressing problems, gathering knowledge from possible sources, and presenting their findings through reports. The experience gained through the project enables the candidate to solve real world problems. Such joint supervisions benefit stakeholders to mentor the students by solving sub tasks of their projects.

The present educational process does not have a system that matches student-stakeholder expectations. Development of such a match module will suggest matches among supervisor's interests and student's ideas. The proposed module will comprise of features such as time lines, peer support and discussions, file storage, checklists, templates, project status, etc., to meet student needs. This module will also assist in monitoring progress and evaluation, and grading student projects. Peer review of large number of project reports would become possible through this module and thus self-assessment would be encouraged among students.

The existing study programme does not provide any form of career guidance. The University also fails to keep track of its graduates and their present employment. Maintaining such records will enable the study programme to be better in preparing students for a variety of prospective employment. It is essential to make stronger career-counselling services available, to connect students with alumni and broaden the focus of the study programme to include the development of more professional skills. Proper guidance in filling out application forms is essential to the students and graduates when they look for job opportunities. Career guidance should extend its services to the students in preparing resumes and filling out application forms.

At present the study programme does not have any arrangements to conduct mock interviews for the prospective graduates before they face an interview. Facilitating with mock interviews will help the students to understand common behaviour patterns and skills that will help them be successful at getting a job, communicating ideas and thoughts, and in life itself. By participating in mock interviews students will also receive feedback on their performance for future improvements.

Besides conducting workshops, seminars, and mock interviews, internships in industry will enhance the problem solving skills, provide a deeper understanding of industry and develop the personality of students. Student performance during internships will help the stakeholder to identify potential candidates for employment. Moreover, these internships will promote the industries to compete with each other in recruiting talented personnel.

Hence, in relation to the desired performance of the students and graduates, gaps borne out of the present curriculum are:

- Graduates lack the opportunity to apply knowledge, skills and attitudes acquired from their study programme to a real professional setup.
- Students are unable to decide on the suitable career path for their programme of study.
- The existing educational process does not accommodate workshops, seminars and tech talks as part of its curricula.
- The study programme lacks research-oriented projects incorporating industrial joint supervision.
- Career guidance has not been a high priority in the present study programme.
- The students and graduates are weak in effectively preparing their resumes, duly filling out job application forms and facing interviews.

To narrow down the gaps or identified problems the following solutions are proposed in this activity entitled "Improving Career Prospects" as an intervention from the QIG:

- The present study programme should provide counselling and career guidance for the students.
- The educational process should organise industrial visits and trade fairs to strengthen the student-stakeholder links.
- The educational process needs to incorporate workshops, seminars and tech talks to enlighten the students with the state-of-the-art technologies.
- The curriculum should adopt industrial collaboration for project supervision which will benefit the students and academics to enhance their knowledge horizons and to maintain good relationships with industries.
- The educational process should develop a match module that will suggest matches among supervisor's interests and student's ideas.
- The study programme should incorporate stronger career-counselling services to the students.
- The present study programme should engage experts from human resource management divisions in industries in rendering help to the students in preparing well structured resumes, filling out application forms and conducting mock interviews.
- The existing curriculum needs to be revised to accommodate internships for duration of at least three months period to enhance knowledge and increase immediate employability.

### 3.3.2. Objectives

- Improve the participation in curricular and extracurricular activities
- Enhance leadership and teamwork skills
- Improve awareness of the industrial environment
- Develop links with industries
- Exposure to the research and development (R&D) of industries
- Face interviews successfully.
- Prepare resumes diligently.

### 3.3.3. Innovative Specificity

Innovative features of this activity are to stimulate the students to set up a clear career goal, become aware of career opportunities and develop multidimensional personality skills which will motivate them highly in the study programme. Creative features of this activity are to introduce a web-based module which will bring the students, academics and stakeholders much closer in sharing knowledge and expertise in expanding students' horizons in building a career path and encouraging students with self assessment; facilitating mock interviews; and facilitating joint project supervision both involving academia and industry. This activity will have a significant impact on the graduates to contribute in the development of the nation.

# Chapter 4: Implementation and Sustainability Plan

## 4.1. Mechanism and Design

**Activity 1:** The activity entitled "Revamping the curricula to Improve Employability" is proposed, so that the graduates of the study programme shall confidently compete in the emerging job-market from the modern interdisciplinary area and have up to date knowledge in the subject areas and have the attributes required by industries especially in real-life problem solving skills and applied research skills. To achieve these objectives this activity is refined into two sub activities:

1. Incorporating interdisciplinary courses
2. Introducing job-oriented projects and assignments

Implementation of these two sub activities requires curriculum revision and the necessary approvals of the Faculty Board and Senate. To introduce the relevant interdisciplinary courses respective staff from the collaborative departments with the assistance from the outside experts shall design the objective, syllabi and the evaluation of the courses, in consultation with stakeholders and alumni. While they are designing the necessary laboratory facilities, teaching learning software and textbooks shall be acquired to facilitate the delivery of these innovative courses.

Compulsory research project course units shall be introduced in the final year General Degree curriculum structure with the approval of the Faculty Board and Senate. This course unit shall be of a job-oriented and applied research in nature. Departmental staff shall effectively design pool of single or group projects to enable the students to choose from the pool. Students shall pursue the project with their assigned supervisors. Moreover it is also planned to incorporate practical oriented assessments in the evaluation processes of the course units at all levels. Departments shall devise such assignments appropriately and it varies from course to course. To facilitate this activity student should be provided sufficient laboratory access and self learning facilities: software/ computers, text books, manuals, Xerox or printing facilities.

**Activity 2:** Interactivity of the teaching and learning will be improved through the proposed activity entitled "Facilitating interactive teaching and learning processes". By considering the factors which constitute to the success of the activity, it is further divided into following two sub activities:

1. Improving learning environment
2. Providing e-Learning facilities

Learning environment will be improved by upgrading the lecture halls, revamping the environment to encourage group activities and organising sports, cultural and social events. The support of human resources of other entities such as department of drama and theatre, physical education unit, Media Resource Training Centre, Health Centre will be required when organising events. Through this students also get a chance to interact with other disciplinary students and staff. Further, existing physical resources such as lecture halls, garden benches, cafeteria, wash rooms and toilets will be effectively used to improve the learning environment without constructing anything new.

An e-Learning infrastructure and e-Learning content development infrastructure will be established to facilitate e-Learning. In addition to that an automated e-Library system also will be introduced to students. Once the e-Learning system is established, the system will be maintained by the University technicians. Further, existing computer application assistants and interested staff will be trained on e-Learning content development. The staff of department of computer science has sufficient expertise to provide training for staff and students on e-Learning systems. Existing resources procured under HETC-UDG grant for students will be utilized to facilitate e-Learning. Further, students and staff will also be trained on e-Learning systems under the above mentioned project. A tutors' room will be used for e-Learning content development laboratories and existing rooms at the chemistry will be converted to setup audio-visual studio. Video conferencing facilities will be set up only in Chemistry, Mathematics and Physics departments.

**Activity 3:** In order to improve the graduate's acquaintance with the industry's structure, expectations and the culture, to acquire basic professional reflexes and relationship skills, to understand their future career prospects within the industry and to apply a combination of knowledge, skills and attitudes acquired throughout their study programme to a real professional setup, the activity entitled "Improving career prospects" is proposed. By considering the factors, which constitute to the success of the activity, it is further divided into following two sub activities:

1. Enhancing student-stakeholder links.
2. Enhancing career guidance and counselling facilities

A team of senior members from each department of the study programme will sign an MOU with the respective consortium of industries such as Sri Lanka Association of Software and Service Companies (SLASSCOM) to arrange industrial visits for the students. Students and some of the academic staff members will make at least one industrial visit in a year. By sustaining the link established as a result of the MOU, trade fairs can be arranged annually for two days continuously. Intermittent workshops, seminars, tech talks can be arranged by inviting resource persons from the industry. As a consequence of these activities industrial experts can pinpoint small research oriented projects which could be jointly supervised academics and industrial experts and done by the students. This joint process can be expedited by the use of a matching module of ideas and interests. The matching module can be developed with the input from academics and the industrial experts and can be developed with the assistance of the staff members attached to the Computer Unit of the University. By getting the assistance from the human resource management experts in the industry, mock interviews shall be organized from time to time. A team consisting of well experienced senior staff of the faculty and experts from the industry shall form a pool of counselling and career guidance advisors, and shall provide counselling and career guidance assistance to students whenever necessary. Senior academics will identify potential staff members of the faculty to function as student mentors in guidance.

For conducting workshops, seminars and mock interviews video-conferencing equipment and Audio Video equipment will be needed with high-speed Internet connection in lecture rooms. Contact rooms for counselling are also needed and the space available in the student complex and lecture theatres in few departments of the study programme shall be utilized for this purpose. Modernizations of these lecture halls to conduct videoconferences and mock interviews needs to be done. For the development of the matching module few server type computers will be needed.

Free space available in front of the Parameswaran temple will be utilized to hold trade fairs. The university can provide personnel support and other logistic support to carry out this activity.

### 4.2. Implementation Schedule

**Table A:** Activity Plan

| Activity | Sub-Activity | Year 1 | | | | Year 2 | | | | Year 3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 |
| Revamping the curricula to improve employability | **Incorporating interdisciplinary courses** | | | | | | | | | | | | |
| | Brainstorming sessions with stakeholders and alumni | | | | | | | | | | | | |
| | Identifying the experts | | | | | | | | | | | | |
| | Designing interdisciplinary courses | | | | | | | | | | | | |
| | Providing study material / software / textbooks | | | | | | | | | | | | |
| | Approval from the authorities | | | | | | | | | | | | |
| | Enhancing teaching-learning facilities to accommodate interdisciplinary courses | | | | | | | | | | | | |
| | Offering interdisciplinary courses | | | | | | | | | | | | |
| | **Introducing job-oriented projects and assignments** | | | | | | | | | | | | |
| | Brainstorming sessions with stakeholders and alumni | | | | | | | | | | | | |
| | Approval from the authorities | | | | | | | | | | | | |
| | Preparing a pool of projects in consultation with the stakeholders | | | | | | | | | | | | |
| | Improving laboratory facilities for students to carry out projects | | | | | | | | | | | | |
| | Designing and incorporating job oriented assignments in the evaluation process | | | | | | | | | | | | |
| | Implementing project | | | | | | | | | | | | |
| Facilitating Interactive Teaching-learning Processes | **Improving Learning Environment** | | | | | | | | | | | | |
| | Renovating of lecture halls | | | | | | | | | | | | |
| | Improving Audio-Visual and Wireless facilities | | | | | | | | | | | | |
| | Refurbishing the students' learning centre | | | | | | | | | | | | |
| | Revitalising societies and initiating new student societies | | | | | | | | | | | | |
| | Refurbishing toilets | | | | | | | | | | | | |
| | Refurbishing and extending existing garden benches | | | | | | | | | | | | |
| | Renovating cafeteria facilities for science students | | | | | | | | | | | | |
| | Organizing drama festivals, cultural programmes and sports activities | | | | | | | | | | | | |
| | End of semester gathering | | | | | | | | | | | | |
| | **Providing e-Learning** | | | | | | | | | | | | |
| | Setting up server infrastructure | | | | | | | | | | | | |
| | Setting up video-conferencing facilities | | | | | | | | | | | | |
| | Establishing content development laboratories | | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Setting up an audio-visual studio for physical sciences | | | | | | | | | | | | |
| | Implementing automated e-Library | | | | | | | | | | | | |
| | Training staff and students on e-Learning and e-Library systems | | | | | | | | | | | | |
| | Training staff on e-Learning content development | | | | | | | | | | | | |
| Improving career prospects | **Enhancing the employability of the graduates in industries** | | | | | | | | | | | | |
| | Industrial visits | | | | | | | | | | | | |
| | Organising trade fairs | | | | | | | | | | | | |
| | Conducting workshops, seminars, tech talks | | | | | | | | | | | | |
| | Joint supervision involving both academia & industry | | | | | | | | | | | | |
| | Developing a match module for student-stakeholder expectations | | | | | | | | | | | | |
| | **Enhancing career guidance and counselling facilities** | | | | | | | | | | | | |
| | Counselling | | | | | | | | | | | | |
| | Providing awareness on employability opportunities | | | | | | | | | | | | |
| | Curriculum vitae / Resume preparation | | | | | | | | | | | | |
| | Guiding to fill out of application forms for jobs | | | | | | | | | | | | |
| | Conducting mock interviews | | | | | | | | | | | | |

The three activities proposed in this QIG proposal requires various types of resources to carry out the sub activities described and require continuous maintenance of such resources.

### 4.3. Resources Required

The University community of the University of Jaffna is continuously thriving to strive in spite of the setbacks and drawbacks, which resulted as a result of the continued insurgency that prevailed in the Northern Sri Lanka till mid 2009. The University administration has already expressed its willingness and commitment in the successful implementation of projects such as IRQUE and HETC for the uplifting of the University education. The Operational Technical Secretariat (OTS), which was previously called as the Local Technical Secretariat (LTS) is well established and has the manpower to handle implementation of larger projects such as HETC. The OTS will function as the coordinating office for the project implementation and the HETC head office. The higher academic body of the university, the Senate, will periodically review the project progress and makes its observations. The Faculty Board of Science will monitor the faculty level activities of the project and shall monitor the progress of the project.

In order to keep track of implementation process of the project and its progress a faculty level monitoring body will be formed. The dean of the faculty shall be the chairperson of this monitoring body and senior academics, who have prior experience with IRQUE and the HETC projects, shall be the members of this monitoring body. This monitoring body will periodically monitor, evaluate and advice on various aspects related to the implementation of the project and the successful completion of the sub activities. The coordinators of the project shall have already been appointed by the Vice Chancellor on the recommendation of the Faculty Board.

The Project implementation committee shall be formed comprising of the Dean of the Faculty as the chairman and the project coordinators, persons in charge of each activity, a senior assistant bursar, the assistant registrar of the Faculty of Science and two student representatives (one female and one male) as the members. This project implementation committee shall facilitate the execution of the implementation plan: procurement of goods and services, coordinating activities, and communicating with the OTS and the PPDU on project administration and progress. This project implementation committee shall periodically submit reports to the Faculty Board and which will be passed onto the Senate. This committee will also maintain links with employers and alumni. Setting up of monitoring bodies with the participation of senior academics with much experience and other interested parties will ensure the commitment and the successful implementation of the project at all levels.

Overall to ensure the objective performance of the project, in accordance with the timeline and the PPDU guidelines, a project monitoring body at university level shall also be established comprising the Vice-chancellor (chairperson), Dean of the Faculty, Director of the OTS, three joint coordinators and an external council member. Periodically, the project monitoring body will review the intermediate performance indicators and shall make necessary recommendations to remove obstacles in achieving the objectives of the project. This committee shall also take follow up actions on any activity that has been observed not to be meeting the desired level of performance.

Sustainability of this project is vital as it entails continuation of the desired graduate performances achieved during the project period.

In this project, interdisciplinary courses will be designed and offered. Once the interdisciplinary courses are designed and offered for the project period, by developing the necessary human resources and acquiring physical resources, sustaining those courses needs some periodic updating on the course content, which can be done with the commitment of the academic staff that has sufficient exposure on the need for revision. The research project for the three-year general degree program shall be introduced and offered under this project. For which a pool of research assignments will be formulated in collaboration with stakeholders and industry, and the necessary expansion of laboratory and self-learning facilities shall be provided under this project. Annually, the pool of research assignments shall be updated with the assistance of the existing staff and the stakeholders to continue to offer the research project component in the three-year general degree programme.

Facilitating interactive teaching and learning processes is one of the activities of this project. It is proposed to develop relevant key competencies among the graduates of the twenty first century; transferable soft skills and lifelong learning attributes by providing conducive teaching and learning environment, and e-Learning facilities. The created conducive facilities would be made available with the approval of the Faculty for the utilization of the self-financed extension programmes and post-graduate programmes during the weekends and vacation. The income generated from such engagement can be used to sustain the established facilities.

Improving career prospects of the students is part of the project and its endeavour; which takes intervention from the proposal to establish. At the end of the project the desired networking with the industry would have been established, and Faculty would have the experience in conducting the trade fairs, and effective career guidance. The recurrent vote of the faculty and, the networking with the alumni and the industrial partners would be sufficient to sustain the quality

of career guidance and counselling. It is apparent that during the project period a number of staff and technicians of the Faculty would be trained in various tasks relevant to this project. Many of the staff in the Faculty are young, energetic and highly motivated, and they would be prepared to do the additional work to train the future generations and to pass on the knowledge and the expertise gathered by them will to others. This will contribute to develop the necessary human resources to maintain the outcome and goals of the project.

After the project completion, regular revision of the curriculum with the participation of stake holders will be modified from time to time by the Faculty according to current needs with experience gained though the project. All the departments involved in this study programme will share the resources that will be acquired for the utilization of this project. By sharing common resources, departments could eradicate wastages and reduce extra expenditure for the procurement of goods, services and works. For example the spectroscopic equipment needed for nanotechnology will be shared both by the Departments of Chemistry and Physics. This will give more responsibility and resource management to the staff. All the departments will share the server machine that maintains the matching module. The printing, scanning and copying facility, which is made available to students shall be kept in a common access area and shall be shared by all students in a more efficient way. This will give an opportunity to share the resources effectively and efficiently.

**The Adoption and the use of Good Practices**

In the writing of this proposal, after attending the workshop for proposal writing, the proposal writers have invited the academics and senior technical staff in the faculty for an academic gathering and have briefed them on the importance of applying for this proposal and have highlighted the key benefits for the students in securing a more suitable opportunities for them at the earliest. Concerns of academics have been noted in the performance of the students in getting highly recognized professional jobs that are most suitable for them. As the result of this discussion, and data gathering from students and recent graduates a set of activities has been set out with targeted goals. The proposed activities and their goals are measurable and during the project implementation period, will be measured from time to time to monitor the project progress. The project monitoring will be carried out at the study programme level, faculty level and University level to ensure that the beneficiaries of this project have attained the set out goals. The monitoring bodies will also ensure that the handling of funds and human resources is done according to HETC, UGC and the Government regulations. Periodic documentation will also be prepared and communicated with the HETC through the OTS of the University. At the completion of the of the project at the end of the two and a half year period, the intended outcomes will be sustained by earning extra funds from utilizing some of the facilities that are acquired by this project for self financed courses conducted by the University during after hours and weekends. Vote from the recurring allocation of the university to the departments could also be utilized for the maintenance of the intended outcomes of this project.

**Table B:** Proposed Budget

| Activity / Sub activity | Estimated Cost (×1000 LKR) | | | | |
|---|---|---|---|---|---|
| | Goods | Works | Services | | Total |
| | | | Consult | Other | |
| 1. Revamping the curricula to improve employability | | | | | |
| 1.1. Incorporating interdisciplinary courses | 3900 | 2630 | 1200 | 800 | 8530 |
| 1.2. Introducing job-oriented projects and assignments | 3470 | 820 | -- | 200 | 4490 |
| 2. Facilitating interactive teaching-learning processes | | | | | |
| 2.1. Improving learning environment | 1800 | 2600 | -- | 450 | 4850 |
| 2.2. Providing e-Learning | 3230 | 200 | 200 | 400 | 4030 |
| 3. Improving career prospects | | | | | |
| 3.1. Enhancing the employability of the graduates in industries | -- | -- | 100 | 2100 | 2200 |
| 3.2. Enhancing career guidance and counselling facilities | 100 | -- | 200 | 600 | 900 |
| **Total** | **12500** | **6250** | **1700** | **4550** | **25000** |

**Table B.1:** Detailed Budget

| Activity | Sub activity | Resources required | Estimated cost (×1000 LKR) | Cost Component (×1000 LKR) | | | | Total (×1000 LKR) |
|---|---|---|---|---|---|---|---|---|
| | | | | Goods | Works | Consult | Other | |
| 1 | **1.1** | | | | | | | |
| | Brainstorming sessions with stakeholders and alumni | 1.1.1. Travelling | 60 | -- | -- | -- | 60 | |
| | | 1.1.2. Food | 60 | -- | -- | -- | 60 | |
| | | 1.1.3. Venue & Accommodation | 80 | -- | -- | -- | 80 | 200 |
| | Designing interdisciplinary courses | 1.1.4. Experts' assistance | 1200 | -- | | 1200 | -- | |
| | | 1.1.5. Workshop: Venue & Refreshments | 600 | -- | | -- | 600 | 1800 |
| | Enhancing teaching-learning facilities to accommodate interdisciplinary courses | 1.1.6. Procurement of Computers: | | | | | | |
| | | 30 PCs | 2500 | 2500 | -- | -- | -- | -- |
| | | 30 UPS | 200 | 200 | -- | -- | -- | -- |
| | | 1 Multimedia Projector | 100 | 100 | -- | -- | -- | 2800 |
| | | Renovation of laboratories: | | | | | | |
| | | 1.1.7. Partitioning and electrical insulations | 800 | -- | 800 | -- | -- | -- |
| | | 1.1.8. Flooring | 600 | -- | 600 | -- | -- | -- |
| | | 1.1.9. Networking | 450 | -- | 450 | -- | -- | -- |
| | | 1.1.10. AC | 450 | -- | 450 | -- | -- | -- |
| | | 1.1.11. Seating facilities | 330 | -- | 330 | -- | -- | 2630 |
| | Providing study material | 1.1.12. Textbooks and required software | 1100 | 1100 | -- | -- | -- | 1100 |
| | **1.2** | | | | | | | |
| | Brainstorming sessions with stakeholders and alumni | 1.2.1. Travelling | 60 | -- | -- | -- | 60 | |
| | | 1.2.2. Food | 60 | -- | -- | -- | 60 | |
| | | 1.2.3. Venue and Accommodation | 80 | -- | -- | -- | 80 | 200 |
| | Improving laboratory facilities for students to carry out projects | 1.2.4. Laboratory equipment | 3470 | 3470 | -- | -- | -- | 3470 |
| | | 1.2.5. Gas line renovation, Seating arrangements | 820 | -- | 820 | -- | -- | 820 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2. | **2.1.** | | | | | | | |
| | Renovating of lecture halls | 2.1.1. Window fittings, Electrical fittings, lecture hall chairs, Floor finishing | 1000 | -- | 1000 | -- | -- | 1000 |
| | Improving Audio-Visual and Wireless facilities | 2.1.2. Presentation kit (Visual presenter, Writing pad, Presenter remote) | 825 | 825 | -- | -- | -- | -- |
| | | 2.1.3. Wireless Access Points | 75 | 75 | -- | -- | -- | -- |
| | | 2.1.4. Sound system and FM microphones | 50 | 50 | -- | -- | -- | -- |
| | | 2.1.5. Automatic Lecture Capturing System | 250 | 250 | -- | -- | -- | 1200 |
| | Refurbishing the students' learning centre | 2.1.6. Window fittings, Electrical fittings, chairs, Floor finishing | 200 | -- | 200 | -- | -- | 200 |
| | Revitalising societies and initiating new student societies | 2.1.7. Organizing events, Encourage publishing of Magazines/ Newsletters | 200 | 150 | -- | -- | 50 | |
| | | Chemical Society | 200 | 150 | -- | -- | 50 | |
| | | Computer Society | 200 | 150 | -- | -- | 50 | |
| | | Physical Society | 200 | 150 | -- | -- | 50 | |
| | | Maths Society | | | | | | 800 |
| | Refurbishing toilets | 2.1.8. Pipeline fittings, Floor finishing, Urinals, Commodes, wash basins for refurbishing 10 toilets | 800 | -- | 800 | -- | -- | 800 |
| | Refurbishing and extending existing garden benches | 2.1.9. Renovating garden benches and Recycle bins | 500 | -- | 500 | -- | -- | 500 |
| | Renovating cafeteria for students | 2.1.10. Setting up water supply, wash basins and initial capital for cafeteria | 100 | -- | 100 | -- | -- | 100 |
| | Organizing drama festivals, cultural programmes and sports activities | 2.1.11. Organising events | | | | | | |
| | | Cultural events | 50 | -- | -- | -- | 50 | |
| | | Drama festival | 70 | -- | -- | -- | 70 | |
| | | Sport activities | 30 | -- | -- | -- | 30 | 150 |
| | End of semester gathering | 2.1.12. Organising gathering, hall arrangements, Refreshments | 100 | -- | -- | -- | 100 | 100 |
| | **2.2.** | | | | | | | |
| | Setting up server infrastructure | 2.2.1. Server, network setup and Backup generator | 2030 | 2030 | -- | -- | -- | 2030 |
| | Setting up video-conferencing facilities | 2.2.2. Video conference kit | 500 | 500 | -- | -- | -- | |
| | | 2.2.3. Display | 100 | 100 | -- | -- | -- | 600 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Establishing content development laboratories | 2.2.4. Purchasing e-Content development Software licenses | 100 | 100 | -- | -- | -- | 100 |
| | Setting up an audio-visual studio for physical sciences | 2.2.5. Audio<br>Audio recorder<br>Directional microphone<br>Surround microphone<br>2.2.6. Video<br>Video camera<br>Software for AV production<br>Setting up sound proof environment | 100<br>50<br>50<br>200<br>100<br>200 | 100<br>50<br>50<br>200<br>100<br>-- | 200 | -- | -- | 700 |
| | Implementing automated e-Library | 2.2.7. e-Books | 200 | -- | -- | -- | 200 | 200 |
| | Training staff and students on e-Learning and e-Library systems | 2.2.8. Consultancy<br>Refreshments for conducting workshops | 100<br>100 | --<br>-- | --<br>-- | 100<br>-- | --<br>100 | 200 |
| | Training staff on e-Learning content development | 2.2.9. Resource person consultation<br>Refreshments for conducting workshops | 100<br>100 | | | 100<br>-- | --<br>100 | 200 |
| 3. | **3.1.** | | | | | | | |
| | Industrial visits | 3.1.1. Travelling | 700 | -- | -- | -- | 700 | |
| | | 3.1.2. Subsistence | 200 | -- | -- | -- | 200 | |
| | | 3.1.3. Communication expenses | 100 | -- | -- | -- | 100 | 1000 |
| | Organising trade fairs | 3.1.4. Logistics and basic infrastructure amenities (cleaning & fitting tents) | 300 | -- | -- | -- | 300 | 300 |
| | Conducting workshops, seminars, tech talks | 3.1.5. Travelling | 60 | -- | -- | -- | 60 | |
| | | 3.1.6. Food & beverages | 60 | -- | -- | -- | 60 | |
| | | 3.1.7. Lodging for resource persons | 120 | -- | -- | -- | 120 | |
| | | 3.1.8. Session material distribution | 160 | -- | -- | -- | 160 | 400 |
| | Joint supervision involving both academia & industry | 3.1.9. Expenses incurred for Supervisors' visits (travel & lodging) | 200 | -- | -- | -- | 200 | 200 |
| | Developing a match module for student-stakeholder expectations | 3.1.10. Consultancy | 100 | -- | -- | 100 | -- | 100 |
| | | 3.1.11. Module development and implementation costs | 200 | -- | -- | -- | 200 | 200 |
| | **3.2.** | | | | | | | |
| | Counselling | 3.2.1. Career Guidance Counsellor's honorarium | 100 | -- | -- | 100 | -- | 100 |
| | | 3.2.2. Setting up an office for Career guidance | 100 | 100 | -- | -- | -- | 100 |
| | Providing awareness on employability opportunities | 3.2.3. Handouts, guides & training manuals | 300 | -- | -- | -- | 300 | 300 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 3.2.4. Cataloguing government gazettes and national employers bureau publications | 100 | -- | -- | -- | 100 | 100 |
| | Resume preparation | 3.2.5. Travelling & lodging for resource persons | 100 | -- | -- | -- | 100 | 100 |
| | Guiding to fill out of application forms for jobs | 3.2.6. Stationeries, photocopies and printouts | 100 | -- | -- | -- | 100 | 100 |
| | Conducting mock interviews | 3.2.7. Honorarium for Experts' assistance in conducting interviews | 100 | -- | -- | 100 | -- | 100 |

## 4.4. Persons-in-Charge

| Activity | Person-in-charge | Designation | Department |
|---|---|---|---|
| **1.** | Prof. R. Vigneswaran | Associate Professor | Department of Mathematics and Statistics |
| | Dr. S. Arivalzahan | Senior Lecturer | Department of Mathematics and Statistics |
| | Mr. V. Senthil | Senior Lecturer | Department of Physics |
| **2.** | Prof. S. Srisatkunarajah | Professor | Department of Mathematics and Statistics |
| | Dr. P. Iyngaran | Senior Lecturer | Department of Chemistry |
| **3.** | Mr. K. Thabotharan | Senior Lecturer | Department of Computer Science |
| | Dr. A. Ramanan | Senior Lecturer | Department of Computer Science |

# Chapter 5: Performance and Results Monitoring

**Table C:** Performance Indicators

| Indicator | Baseline | End of Year 1 | End of Year 2 | Final | Methodology |
|---|---|---|---|---|---|
| **Outcome indicators** | | | | | |
| Employments in non-government sectors | 10% | 15% | 20% | >30% | Feedback from questionnaire |
| Waiting time before getting first employment | > 2 years | 2 years | 1 year | <1 year | Feedback from questionnaire |
| Average students' performance (ASP) | 2.88 | 2.95 | 3.00 | >3.00 | Examination Results |
| **Intermediate Outcome Indicators** | | | | | |
| Course units employing interactive teaching and assessment (in class demonstration) | < 5% | 20% of the total course units | 35% of the total course units | 40% of the total course units | Feedback from questionnaire |
| Enrolment in interdisciplinary courses | Nil | 20% of the total students | 40% of the total students | 50% of the total students | Academic records |
| Students' satisfaction in career guidance based activities | Nil | 20% of the total students | 30% of the total students | > 40% of the total students | Feedback from questionnaire |
| Students' satisfaction with laboratory facilities | 34% | 50% | 70% | > 75% | Feedback from questionnaire |

**Table C.1: Compulsory Indicators – Round 2: Windows 2**

| Performance Indicator | Baseline | | | Year 1 | | | Year 2 | | | Year 3 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Knowledge | skills | Attitude/ mindset | Knowledge | skills | Attitude/ mindset | Knowledge | skills | Attitude/ mindset | Knowledge | skills | Attitude/ mindset |
| Percentage of curriculum targeting | 85.24% | 14.23% | 0.53% | 80% | 16% | 4% | 70% | 20% | 10% | 70% | 20% | 10% |

Knowledge – Intellectual skills, Numeracy skills (If a course of 3credits /45 hrs has 2 credits/30 hrs as theoretical knowledge, calculate it as 66%)
Skills – Practical skills, IT skills, Communication skills
Attitude/mindset – Team work and interpersonal skills, Self management and professional development skills

| Performance Indicator | Baseline | | | | Year 1 | | | | Year 2 | | | | Year 3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Academic Year 1 | Academic Year 2 | Academic Year 3 | Academic Year 4 | Academic Year 1 | Academic Year 2 | Academic Year 3 | Academic Year 4 | Academic Year 1 | Academic Year 2 | Academic Year 3 | Academic Year 4 | Academic Year 1 | Academic Year 2 | Academic Year 3 | Academic Year 4 |
| Proportion of annual hours for industrial trainings/ job placements/ in plant training* | Nil | Nil | Nil | N/A | Nil | Nil | 0.07 | N/A | Nil | Nil | 0.15 | N/A | Nil | Nil | 0.22 | N/A |

*Proportion of annual hours dedicated to industrial trainings/ Job Placement /In Plant training = No. of annual hours dedicated to industrial training / Total No. of hours in curriculum per academic year

The OTS will function as the coordinating office for the project implementation and the HETC head office. The higher academic body of the university, the Senate, will periodically review the project progress and shall make observations on the progress. The Faculty Board of Science will monitor the faculty level activities of the project and shall monitor the progress of the project.

In order to keep track of the implementation process of the project and its progress, a Faculty level monitoring body will be formed. The dean of the faculty shall be the chairperson of this monitoring body and senior academics, who have prior experience with IRQUE and the HETC projects, shall be the members of this monitoring body. This monitoring body will periodically monitor, evaluate and advice on various aspects related to the implementation of the project and the successful completion of the sub activities. The coordinators of the project should have already been appointed by the Vice Chancellor on the recommendation of the Faculty Board.

The Project implementation committee shall be formed comprising of the Dean of the Faculty as the chairman and the project coordinators, persons in charge of each activity, a senior assistant bursar, the assistant registrar of the Faculty of Science and two student representatives (one female and one male) as the members. This project implementation committee shall facilitate the execution of the implementation plan: procurement of goods and services, coordinating activities, and communicating with the OTS and the PPDU on project administration and progress. This project implementation committee shall submit periodic reports to the Faculty Board and thus passed onto the Senate. This committee will also maintain links with employers and alumni. Setting up of monitoring bodies with the participation of senior academics with much experience and other interested parties will ensure the commitment and the successful implementation of the project at all levels.

The Faculty Monitoring Committee and the Project Implementation Committee of the Study Programme will monitor the outcome of the project regularly through measurable performance indicators. This will be considered as an effective mechanism to achieve the final performance of the indicators.