An Overview of Engineering Education in Sri Lanka

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Abstract: *The historical development of formal engineering education in Sri Lanka has gained additional strength with the inauguration of the Faculty of Engineering at the University of Ruhuna. This is the third conventional Engineering Faculty in Sri Lanka after those at the University of Peradeniya and the University of Moratuwa. This paper describes the Ruhuna's developments, degree programs, student admission, field selection, work load and degree requirements. This Faculty's reputation during the last decade has been reflected by students' achievements in several ways, including their employability all over the world. In 2004, all three degrees offered by this new Faculty have received accreditation. This study shows that despite all these achievements and a growing reputation within a decade from its establishment, the Ruhuna is still challenged by the two other engineering Faculties to prove its status to attract and admit a reasonable proportion of all island merit students.*

History of Engineering Education in Sri Lanka

Sri Lanka, officially the Democratic Socialist Republic of Sri Lanka (known as *Ceylon* before 1972) with a land area of 65,610 sq km, has a total population of 20.0 million in 2008. Technical education in Sri Lanka has its roots back in the 19th century. According to Peradeniya (2006), a variant of technical education began in 1893 with the development of a 'Technical School' which was founded in Colombo. It was then renamed as the Ceylon Technical College (CTC) in 1906. In 1942, this college received 'provisional recognition' from the University of London to prepare students for a degree in Engineering.

On the 1st of July 1942, the University of Ceylon, the first University in the country, was established with two colleges, namely the Ceylon University College, and the Ceylon Medical College to prepare students in arts, oriental studies, science and medicine. At that time, the availability of degree courses at the CTC and shortage of funds due to the world war climate were the reasons for lowering the priority of establishing a separate engineering faculty.

In December 1949, after the collapse of an agreement between the CTC and University of London, the government urged the University of Ceylon to set up an engineering faculty by the 1st of July 1950. In 1953 the University of Ceylon's BSc Engineering degree was first awarded, and subsequently the degree courses at the CTC were terminated. However, CTC continues to offer certificate courses in technology and has established few branches (eg, at Katubedda) across the Island.

The University of Ceylon relocated its several faculties to a site of great natural beauty at Peradeniya on the 6th of October 1952, and named it the University of Ceylon, Peradeniya. When the buildings complex for the new engineering faculty was completed in 1964, the faculty moved from Colombo to Peradeniya. From its inception in 1950 until 1971, this faculty was the major source of local engineers to industry. Subsequently, the University of Ceylon, Peradeniya underwent a name change twice to University of Sri Lanka, Peradeniya Campus in 1972, and to the University of Peradeniya in 1979.

In 1972, another campus for engineering education was established under the umbrella of the University of Ceylon, Colombo at Ceylon Technical College at Katubedda, Moratuwa. Initially this was named the Katubedda campus, but later converted to the University of Moratuwa in 1978.

The Open University of Sri Lanka (OUSL) was also set up in 1978 at Nawala, Nugegoda, for the purpose of providing higher educational facilities to persons above 18 years of age with relevant basic

qualifications. The Faculty of Engineering Technology of the Open University of Sri Lanka is one of the pioneers in the delivery of distance education in Engineering in Sri Lanka.

The Institution of Engineers, Sri Lanka (IESL) established in 1956 was the successor to the then Engineering Association of Ceylon, which was founded in 1906 at Anuradhapura by a few dedicated engineers serving in the public sector. The IESL is also conducting a course of (approximately) five years duration equivalent to a degree to enable those desiring to pursue studies with the basic qualification and/or with field experiences in Civil, Mechanical, Electrical and Electronics, Telecommunication & Computer Engineering.

University System

There are currently fifteen universities in Sri Lanka, and the University Grants Commission (UGC) functions as the apex body of the entire University system. The Government of Sri Lanka supports all these universities with the exception of the Open University of Sri Lanka, for the delivery of essentially free graduate education with very low nominal fee. The functions of the UGC include: allocation of funds, maintenance of academic standards, and admission of students to all national universities. Student admission to national universities is purely based on the result of the Island-wide General Certificate of Education-Advanced Level (GCE(A/L)) examination which is conducted annually. In 2006, a total of 201,686 students sat the GCE(A/L) examination, and 119,955 qualified as eligible candidates to apply for university admission for the Academic Year 2006/2007. According to the UGC (2007), 16,776 (8.1% of total sat for exam) were admitted to all universities. Forty percent (40%) of the total number of admissions are based on all Island merits, and the remaining sixty percent (60%) on district merit which is also proportionate to the population of the particular district.

Ruhuna Engineering

The Faculty of Engineering at the University of Ruhuna was officially established on 1st of July 1999 at Hapugala, Galle, Sri Lanka, with the appointment of a few permanent academic staff members. This is the third conventional Engineering Faculty in Sri Lanka after the first at the University of Peradeniya and the second at the University of Moratuwa.

The infrastructure for this faculty was well supported politically and driven by one of the former Education Ministers (the late) Richard Pathirana. As a result, within a short period of time (approximately 3 years) a large scale infrastructure complex was built at Hapugala, including three laboratories; an administration building; a computer centre; a guest house; a lecture theater complex with two large drawing offices, two lecture theatres and two lecture rooms; three student hostels; a canteen with medical unit and student center; an audio visual unit; a library; twenty staff quarters; internal roads and a security building. All of these facilities were designed for quick and easy access, and ample provision was made for future expansion.

An academic advisory committee had been appointed to develop an appropriate program to conduct Engineering Education. Staff from other universities such as University of Peradeniya, University of Moratuwa, The Open University of Sri Lanka, and a few members from industries were included in this committee. The committee's highest priority, while developing new curriculum, was to ensure the excellence of the engineering program, wherever possible within local contexts.

This committee played a vital role in several issues, such as curriculum development; introducing a semester system in engineering education; drafting a developmental programme for first year students; deciding degree titles; credit definition; finalising courses in 'Common Core Course', specialisation courses, technical & general electives; Grades and GPA allocation; setting standards for industrial training; graduation requirements; and the student handbook. With those rapid initiatives in the later part of 1999, a hundred pioneering students were admitted to the faculty early in 2000. The committee achieved many of the teaching aims through introducing various tasks, including small group teaching, project-based learning, a high level of student and staff interaction, and related matters.

Academic departments

Ruhuna has four academic departments, namely the Departments of Civil and Environmental Engineering, Electrical and Information Engineering, Mechanical and Manufacturing Engineering, and Interdisciplinary Studies. The first three departments prepare students for B.Sc.Eng. degrees in disciplines as indicated in their department title.

The academic advisory committee decided to incorporate a substantial amount of multi-disciplinary knowledge into engineering education. With this in mind, a fourth Department of Inter Disciplinary Studies was introduced. As stated above, this department does not offer Degrees, but extends support by delivering courses in mathematics, management, accounting, financing, economics, law, communication, presentation, entrepreneurship, human resource management, meditation, physical education, music, photographic and other similar multi-disciplinary areas.

Semester system in engineering education

From the start, Ruhuna introduced a semester-based system in engineering education to Sri Lanka. In this system, a year is divided into two semesters, and a semester will run for nineteen weeks in total. The time allocations within a semester are: first half (7 weeks), recess (1 week), second half (7 weeks), study period (1 week), examination (2 weeks) and vacation (1 week). The two other Engineering Faculties at Peradeniya and Moratuwa have also adopted a similar semester-based system within two years of Ruhuna's establishment, replacing their old style British system of year-end examinations.

Developmental and training programs

Engineering degree programmes in these three universities are conducted in English. More specifically, first and second year students in Sri Lanka find English difficult because of poor high school preparation. As a result, English is something students endure rather than something they enjoy. With the regard to this fact, at the beginning of the degree program at Ruhuna, a twelve weeks development programme is structured to give adequate fundamental knowledge in English together with computing and presentation skills. Attendance and passing assessments for this program are considered mandatory and a requirement for graduation.

During the four years period of the degree program, two sets of industrial training sessions (10~12 weeks for each) are arranged by the Engineering Education Unit of the Faculty. Placement for industrial training is based on the field of specialization chosen by the student. In addition, at third year level, the department of Civil and Environmental Engineering conducts a mandatory survey camp for about 10 days.

Evaluation of Engineering Admission

As was discussed before, there are three faculties offering conventional 'Engineering Education' namely at the University of Peradeniya (*say Peradeniya*), the University of Moratuwa (*say Moratuwa*) and the University of Ruhuna (*say Ruhuna*). The available degree programs differ slightly between faculties. There are six major disciplines available at Peradeniya such as Chemical and Process Engineering, Civil Engineering, Computer Engineering, Electrical & Electronics Engineering, Mechanical Engineering, and Production Engineering. Similarly, Moratuwa has seven major disciplines such as Civil Engineering, Computer Science and Engineering, Chemical and Process Engineering, Electrical Engineering, Electronics and Telecommunication Engineering, Material Engineering and Mechanical Engineering. However, the options at Ruhuna are limited to three namely; Civil and Environmental Engineering, Mechanical and Manufacturing Engineering, and Electrical and Information Engineering.

In addition, Moratuwa admit nearly hundred students per year for Earth Resources Engineering and Textile Engineering. The standard of these students ranks are lower than the standard of the students admitted to the conventional engineering education program described in the above paragraph.

Eligible students can apply to any of these three universities (Moratuwa, Peradeniya and Ruhuna) for admission. When a student applying for an engineering degree program, he or she should indicate first, second and third choice of Universities preference to UGC, however student selection is always solely

based on their merit rank as well as for a lesser extends on the distance between University and his or her home. At the time of preparing application for university admission, there are several matters influencing a student's preference such as the general reputation of the University, available field selections as stated above, staff strength, industrial collaborations of the University, distance from the commercial city and similar relevant other issues for individuals. The Moratuwa has several advantages over these issues, and the main advantage is it location which is with in a 12 km distance from CBD area of Colombo city (largest commercial city). The other two Engineering faculties are located approximately 120 km, and it may take a minimum of three hours drive from Colombo. Therefore considering it location together with wider coverage of its degree program as stated above, majority of the good students prefer Moratuwa to other Faculties. As a consequence of all these matters, the quality of incoming students at Ruhuna is always at a lower level as detailed in Table 1.

Table 1. Level of students to engineering faculties in 2005/2006

University	Number of students (% from group)			Total (1091)	All island rank of 1st student to faculty
	Top 10%	10-50%	51-100%		
Moratuwa	101 (93%)	363 (83%)	98 (18%)	562	1
Peradeniya	8 (7%)	53 (12%)	273 (50%)	334	17
Ruhuna	0 (0%)	21 (5%)	174 (32%)	195	476

This table has been prepared based on the statistics for the admission for the academic year 2005/2006, where a total of 1,091 students were admitted to three faculties. Results revealed that among the admissions, 93% of the top (top 10%) students were admitted to Moratuwa, and only 7% to Peradeniya and none to Ruhuna. It is also indicates that Moratuwa enrolled the best student (best student out of 1,091 students admitted to all engineering faculties) from the merit list, and likewise Peradeniya the 17th ranked student on the list and Ruhuna the 476th ranked student on the list as their first student based on the GCE(A/L) exam. This analysis revealed that Ruhuna should improve its status in the nation to admit a higher proportion of merit students.

Evaluation of Field Selection

When a student enters to one of these three Faculties, he or she can not decide his or her specialisation for the degree. The area of specialisation allocated to an individual student is based of his or her performance in the first year. Semester Grade Point Average (SGPA) in the first and the second semesters are considered to allocate the field (specialisation) of a student choice. The comparison of field selection in the academic year 2006/2007 at Ruhuna is shown in Table 2. The faculty has decided to distribute the 185 students equally to there engineering departments: accordingly 62 students to Electrical and Information (EIE), 62 students to Civil and Environmental (CEE) and remaining 61 students to Mechanical and Manufacturing (MME).

Table 2. Allocation of students to departments in 2006/2007

Department	Students' ranks			Total (185)	Given preference		
	Top 10%	10-50%	50-100%		1st	2nd	3rd
EIE	100	57	0	62	62(100%)	Nil	Nil
CEE	0	34	40	62	40(65%)	22(35%)	Nil
MME	0	9	60	61	17(28%)	22(36%)	22 (36%)

As shown in this Table 2, EIE is the most popular field for students, CEE is ranked second and MME last. All students admitted to EIE received their first preference, similarly among the students admitted to CEE, only 65% were allocated their first and 35% their second preference, and like wise for MME: only 17%, 36% and 36% received their first, second and third preferences, respectively. This indicates that many of the mechanical engineering students were forced to do their least preferred area for their

degree. Approximately 36% of the students in academic year 2006/2007 at Ruhuna did not qualify for the faculty's entry requirements to follow the specialisation of their choice, which is a very unfortunate situation.

Despite of all these difficulties, this Faculty's high reputation during the last decade has been reflected by students' achievements. Notably the number of Honours degree awarded, placement and completion of Master and doctoral studies abroad with scholarships, and employability at globally-reputed companies and UN organizations.

Workload and Degree Requirements

At Ruhuna, one credit shall typically be equivalent to academic work involved in attending one hour of lecture/ two hours of seminar per week; or two to four hours of laboratory/ field/ design work per week, over a period of one semester. A Work Camp/ Training Course of two weeks' duration or Industrial Training attachment of four weeks' duration is considered as the equivalent of one credit. The modules offered in a semester and the number of credits assigned to each module is determined by the Faculty Board and the students duly informed ahead of the commencement of that semester. The evaluation of Overall Grade Point Average (OGPA) is based on the Four Point Grading System adapted in several universities (i.e., 4 points for highest Grade, and zero for fail grade).

A student admitted to the degree programme in the Faculty can be a candidate for a degree with Honours. A student shall be deemed to be eligible for the award of the degree of B.Sc.Eng. with Honours on satisfying the following requirements:

(a) A minimum total of 144 credits, excluding credits for Industrial training, but including a minimum of 14 credits from the list of General Elective modules and a minimum of 130 credits that comprise all the mandatory core modules and a number of Technical Elective modules chosen from the list offered by his/her specialisation course.
(b) Completion of the Developmental Programme, Industrial training and any other mandatory requirements prescribed by the Faculty Board to the satisfaction of the Dean.
(c) Completion of all programme requirements to the satisfaction of the Dean within a period of four academic years from the commencement of the Common Core Course.
(d) A residence requirement of four academic years as a duly registered full time student of the University.
(e) An Overall Grade Point Average (OGPA) not less than 2.70.

The award of B.Sc. Eng. degree with Honours will be according to the OGPA values stipulated below.

OGPA	Honours Awarded
OGPA $\geq$ 3.70	First Class Honours
3.70 > OGPA $\geq$ 3.30	Second Class Honours Upper Division
3.30 > OGPA $\geq$ 2.70	Second Class Honours Lower Division

A student who has not satisfied all the eligibility requirements for Honours stated above will be eligible for the award of the degree of B.Sc.Eng. on satisfying the minimum graduation requirements stated above in clauses (a), (b) and (e), with the completion of all programme requirements to the satisfaction of the Dean within a period of eight academic years from the commencement of the Common Core Course.

Accreditation

The accreditation of an engineering education programme by the IESL follows an evaluation of matters which involves the structure of the academic programme, the curriculum components and syllabi, laboratory, design, field and project work, and industrial training, number and quality of the academic staff, achievement of the students, teaching facilities such as class rooms, study areas, the library, computing and IT facilities, the general infrastructure and finally the quality administration systems. A programme that fully satisfies the minimum standard for accreditation set by the Institution is eligible for full accreditation.

In 2004, all degrees offered by this new Ruhuna received full accreditation from the Institution of Engineers, Sri Lanka (IESL). Full accreditation is normally given for a period of five (5) years from the date of accreditation. With this achievement all engineering degrees offered by the three national universities are accredited by IESL.

Conclusion

The existence of a few civil structures in Sri Lanka, for example; 'Kandy Lake' which was build in 1807, could be considered as landmarks for the application of engineering knowledge over the last two centuries in this country. Another example is the existence of The Institution of Engineers, Sri Lanka (formally known as Engineering Association of Ceylon), which was founded in 1906, is a solid body representing practicing engineers over a period of hundred years. However, formal Engineering education in Sri Lanka only has its roots back to 1942. Currently, three universities are offering engineering education in Sri Lanka for selected candidates from an Island wide examination. In addition, there are two other engineering educational programmes available at The Open University of Sri Lanka and at IESL.

The level of students admitted to the programme reflects the strength and the weakness of the engineering program at a university; and the recent trend shows that the University of Moratuwa ranked the highest. In spite of having to contend with many difficulties, the Ruhuna graduates quality professionals to the nation and has maintained a good record of teaching, high quality research, and provides well-structured public services to the society. Ruhuna's reputation during the last decade has been reflected by the achievement of several of the students and staff as well as by administrative achievements. With all these achievements and its growing reputation within a decade from its establishment, the Ruhuna is still challenged by the two other engineering Faculties to convince the nation of its status and ability to attract and admit a reasonable proportion of all island merit students.

Recommendation

Over the last decade, Ruhuna has learned educational lessons and gained adequate experience to propose new directions. Therefore Ruhuna could differentiate itself against the established players by focussing more emphasis on how it could adopt a modern state of the art world class institution for engineering education and thus provide students with a more appropriate and superior education aimed at improving their employment prospects. In addition, if the industrial collaboration, research and innovation could be strengthened, then Ruhuna would occupy a batter rank above its present position.

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