REFLECTIONS AND SUGGESTIONS BASED ON PAST CURRICULA IN MECHANICAL ENGINEERING

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Since I joined Textiles in 1976, I do not know exactly how the teaching of mechanical engineering evolved at Moratuwa. When I followed the course myself between 1968 and 1973, I did so fairly diligently, and only felt how it could be better when I came for my postgraduate studies. Of course at the time the course had barely begun at the CCT, there were many shortcomings. The lecture theatres were not ready, the training was much of a waste of time, and there was no stability of anything due to the insurrection etc. Since then the technology has moved on particularly due to computers and its influence in industry and academic activity including teaching (or learning as you may say).

After some twenty years or so now, I believe there will be great deal of accumulated wisdom at Moratuwa on teaching engineering courses, as well as the opinions of new staff who have been educated abroad, where engineering will be stronger than in Sri Lanka. What I can contribute are a few thoughts based on my experience during the last 10 years at Leeds.

I believe mechanical engineering is still in high demand at Moratuwa and Peradeniya (along with the other engineering disciplines) as it used to be the case. Over here engineering does not seem to cause the same excitement, as the term still has blue collar connotations. Guys who do machining are still referred to as engineers here. Apparently mostly for that reason, engineering does not seem to attract the best students here. I do not think that this is true in Sri Lanka because of the high competition for university entrance, especially into engineering courses.

For this reason I suppose the entrants into engineering courses in Sri Lanka are continuing to be generally good in their mathematics. So for that reason it seems justifiable that the draft course still has a large mathematics component in it. Perhaps on account of the increasing use of computers for problem solving, there has been a general decline in the mathematical skills among the university entrants, and much impetus in presently given in schools here to remedy the situation. I think we should not go soft in teaching mathematics, so that our students may not get into the same difficulties as those entering engineering studies over here.

However teaching mathematics as it is taught to mathematics undergraduates is of not much use to engineering graduates. If the mathematics comes from the service Mathematics department, it is unlikely that what they teach will have much of, say a mechanical engineering flavour to it. While undoubtedly a certain amount of core

mathematics is essential, quite a lot of mathematics taught to mechanical engineers should centre around applications to mechanical engineering problems. I am sure you will agree that doing this will be more beneficial as students will relate the mathematics they learn to actual applications and that will be very useful when they start practising. It is unlikely however that the Mathematics department will be able to provide such a discipline oriented bias in their courses.

Engineering courses in Sri Lanka are of 4 years duration. It was believed that the first year was in effect a unification year which allowed for variation in student background etc. to be overcome, as well gaining sufficient mastery of English. Is the first year still common to all first year students, or is it now going to be specialised? The inclusion of fluid mechanics and thermodynamics in the first year seems to suggest that the Semesters 1 and 2 are not common to all. The module titles electrical engineering and electronic engineering are perhaps not appropriate, as surely at this level they can only study what we used to call electrical technology and electronics. The term "engineering" implies the creative aspect, design etc.

I believe the course has the right mix of subjects. When the students pass out they should be conversant in a couple of programming language such as C and Visual Basic, and be familiar in the use of basic software tools such as Microsoft Office. They should have sufficient familiarity with electronics, microprocessor based control, and mechatronics. Further they should be familiar with engineering materials and manufacturing processes.

Importantly they should have good communication skills, both oral and written. The course should have a sufficient amount of report writing and oral presentations. Here we have a module called Case Studies, which involves a few projects, each of which involves the students researching for information, and carrying out the task (may some testing or similar investigations), writing a report on the solution proposed, and then presenting it before the teachers involved and the class. About 3 weeks are devoted to each exercise. This can be done in the 3rd year. In the final year, the students give a similar presentation on their project. These presentations are assessed and contribute a mark towards the final mark in the module. The presentation involves preparing visual material and posters where necessary. Each presentation will be 10-15 minutes long. In large classes, a group may handle one assignment, and the whole group participates in the presentation. Students receive feedback from the staff and their peers.

The industrial training should be well organised, with the participation of engineers from the host institutions, so that the activities to be performed by students are well documented so that they have a well identified set of activities to be completed. Reports should be prepared, and an oral examination carried out based on the report. This may well be the practice now, but surely this will be the only way they students can begin put their knowledge to practice, and feel confident to be creative when they

become employed. The practice of generally leaving the work to subordinate technical staff, with the engineer mainly performing a managerial activity has to change. It is worth considering why we are still weak in producing any worthwhile machinery in Sri Lanka, why the CTB wrote off too many buses by failing to maintain them properly, why the buses they built always were rather crudely constructed etc. need to be considered.

Student centred learning is apparently going to be promoted in the new courses, and this is made possible by the use of computers in teaching. Over here there is a move to increasingly adopt this as a way of reducing staff time involvement, to reduce staff numbers involved (for cost cutting) and free more of the time of existing staff to funded research. Whether this will be as effective as traditional lecture based teaching remains to be seen. However any effective implementation of this demands developing course material in electronic form, and in a format suitable for computer based delivery. Surely it will be more suitable for certain types of courses more than for others. In a modular course, the course materials should in any case be available fully written, as it makes the delivery more proof to problems due to staff illness or absences etc. It will be not be sensible to start until mechanisms are in place to ensure the staff can effectively made these preparations.

While we would be unable to invest in a lot of expensive machines in our labs, I believe a lot of things that used to be done using such equipment can now be done by computer simulation, and very realistic user interfaces are available (consider flight simulators). I therefore things that we should invest in getting enough good computers, and make maximum use of that technology to equip our graduates with good computer skills that suit engineering. Mechanical engineers are very adaptable, and due to their good mathematical background, can move to handling other specializations. Proficiency in IT is in great demand everywhere, and if we provide for it, I am sure the new graduates will be very employable anywhere.

I believe the education of engineers has to also address the problem of retaining their services for the motherland. However from the present reality this will only be possible if our industry is strong enough to absorb the majority of them. This is also a national policy issue which is rather beyond our control. Our aim should be to equip them to suit the present times wherever they may be employed.

The writer gained his B.Sc. in mechanical engineering from University of Moratuwa in 1974. He carried out postgraduate research at the University of Leeds, UK, on high speed electrohydraulic servomechanisms for use in warp knitting machinery. Since 1990, he is attached to the School of Textile Industries of the same university, where teaches weaving technology and carries out research in instrumentation and mechatronic applications in textiles. He is a corporate member of the IMechE and the Institution of Engineers, Sri Lanka, and a Fellow of the Textile Institute.