

MEng by Taught Course: The UTM Scenario

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Abstract - The increased complexity and rapidly changing nature of technology has increased the demands for scientists and engineers to acquire continuing education and up-to-date work skills in order to cope with these challenges. No where are these needs more pronounced than in Malaysia as the country slowly but surely ploughs its course in meeting its vision of becoming a fully developed nation by 2020. Acknowledging this acute need for providing continuing education and further learning, many local universities have responded by offering a wide range of post-graduate courses. Significant emphasis on higher learning above the basic degree has shown an increase in the past 5 years. The design of these courses depends on many factors such as how each institution perceives the needs of the nation, its vision and definition of its own role in helping to fulfill these needs, response and input from industries, students expectations, available facilities and capabilities of teaching staff and so on. Therefore no two courses are ever the same as the inputs, transformation mechanisms and expected outputs of the programmes vary greatly from one institution to another. This paper discusses the factors influencing the curriculum design of a Master in Mechanical Engineering by coursework programme at the faculty of Mechanical Engineering, UTM. The programme with its theoretical, experimental and numerical approach fulfils the requirement of academia in colleges, university colleges, polytechnics and institutions of higher learning which have sprung up in recent years. Through provision of a deliberate selection of a wide range of specialised academic subjects, the course also addresses the needs of industries and government institutions in terms of more in-depth study of fundamentals in mechanical engineering. Some innovative features of the program such as its Independent Studies, Graduate Seminars, and University-wide free electives are also highlighted in line with world-wide changes in postgraduate education. The paper also highlights other outstanding issues which need to be resolved in order for this course to help propel Malaysia to be a regional and international education hub in line with vision 2020.

1. Introduction

Science and engineering continue to be of great importance in meeting the national goals of increasing economic productivity and competitiveness,

strengthen national security and achieve other national objectives. The Knowledge-based Economy Master Plan released under the auspices of the Ministry of Finance to cope with the challenges of the century must be supported by knowledge intensive efforts [1]. The former Prime minister, Tun Dr. Mahathir Mohamad in his Vision 2020 blueprint said that *“knowledge will not only be the basis of power but also prosperity...[and it] is a must if we want to progress and develop”* [2]. Thus, one of the seven key factors identified to spearhead the developments towards meeting vision 2020 is *“cultivating and securing the necessary human resources, emphasizing on education, training and retraining, as well as well as life long learning”* [3]. Educating and developing knowledgeable workforces through continuing education and lifelong learning require significant and strategic education platform which many local universities have come forward to provide. Each higher institution response differs in their qualitative and quantitative offerings of wide variety of post-graduate courses, available facilities and capabilities of teaching staffs and so on. No two courses are exactly the same as the inputs, transformation mechanisms and expected outputs of the programs vary from one institution to another. With more international students arriving from the Indian subcontinent, the Middle-East, and even some African countries for continuing education, local institutions have become competitive in the structuring of the programs offered.

The Master in Mechanical Engineering by coursework program at the Faculty of Mechanical Engineering (FKM), UTM was designed with theoretical, experimental, and numerical curriculum approach. The program which started in 2001 provides a strong foundation which fulfills the requirement of academia in colleges, university colleges, polytechnics, and institutions of higher learning from the global network. Being one of the oldest and established technological institutions in the country, UTM is financially able and well-equipped with assets both in the human resource development (HRD) and facilities to provide the opportunity to other young academia and potentials to acquire and upgrade the knowledge necessary in facing the challenges of the increased complexity and rapidly changing nature of technology. At the same time the program addresses the needs from modernization of industries and government institutions through the provision of a wide selection of specialized subjects. Having lecturers

with master and doctoral degrees and backed by their research and consultancy exposure, enhances the credibility of the program by a public University such as UTM. Some of these features will be discussed in this paper together with other outstanding issues that need to be resolved in order to place Malaysia as a recognized regional and international education hub.

2. Needs and Market Demands

The number of graduate students registered for the Master Programs in UTM has shown a constant 2% increase over the past three years, with about 10 - 14 graduate students for every 100 students enrolled (baccalaureate, master and PhDs only), as shown in Table 1. Although the percentage of Master students at FKM stays constant, the actual number of students did increase over the years.

Table 1: Enrolment of Master Students [4].

| Year | Students at FKM |
|------|-----------------|
| 2002 | 115 |
| 2003 | 141 |
| 2004 | 178 |

This increase in numbers has prompted the MEng. Committee by Taught Course to review and restructure the program such that its content is at par with world standards. There are three programs running at the faculty; Pure Mechanical, Advanced Manufacturing Technology, and Marine Technology. The Program in Pure Mechanical is currently the only one offered by a public university in Malaysia, Universiti Tenaga Nasional (UNITEN) being the other university offering a similar program.

Some of the sources of demand for such a program have been identified. First would be the professionals or practicing engineers intending to increase knowledge and training to further their career, or to be better able to deal with problems in their field. The academia and universities need a program for the academic staff training at master level and above. With a high foreign exchange rate, a local university that can provide this education is needed. This program strives to fulfill this need.

As we compete with cheaper industrial markets like Vietnam and China, we cannot rely too much more on assembly line type of industry. More mature and higher end industry that emphasize more on product development and design, which demand a higher level of expertise has to be developed in Malaysia to keep us competitive. For this, the government keeps allocating more funds through IRPA and other schemes to promote research in fundamental and applied fields so as to make the nation a center of progress and knowledge. These researches demand more people trained at a higher

level so they can be conducted. The proposed master program attempts to address these demands.

The government also envisions Malaysia to be an educational hub catering to regional and international higher education demands. Our balance of affordability and technological knowledge makes us attractive to international students, especially within ASEAN and also among Middle Eastern countries. The master program also strives to meet some of these perceived needs.

Balance is needed to fulfill the demands from both industry and academia. The industry needs a program that supplies knowledge that is directly applicable to its needs. The academia and universities need a program that will equip a student with solid fundamentals that will be useful in doing academic research to expand the frontier of knowledge. Where coursework is involved, it is important that a graduate program ensure quality control of the “products”. As such academic staffs The MEng Program by Taught Course at the Faculty of Mechanical Engineering is designed to address these requirements with the following features;

- A solid grounding in basic engineering with compulsory courses in Advanced Engineering Mathematics, Computational Methods and Research Methodology.
- Flexibility with a broad and varied choice of elective courses for the students to take for their specific needs. These courses are designed to have a balance between solid fundamentals and current applications.
- An open approach to learning with the Independent Study Module/Course which allows a student to pursue a study under the expertise of professors and industry experts.
- A broadening of horizon with attendance to the Graduate Seminar so that students can see the latest research done by other experts of their field.

3. Problems and Opportunities

This exercise also exposes some shortcomings and inadequacies that need to be overcome to fully realize the full potential of this program. However, these can also be viewed as opportunities to improve and grow the faculty in the directions where these weaknesses have been identified.

Foremost is faculty expertise. In trying to offer various specialized subjects to cater to demands from various quarters, we found that some areas are lacking in expertise. To handle this, the faculty can direct young tutors and lecturers to pursue advanced degrees in these identified areas.

With current emphasis on computers and computer modeling and analysis, computing facilities at the faculty has to be upgraded. The internet connection will need to be available 24/7. The number of workstations and number crunching servers also need to be increased since the current ratio of student to workstation is still below recommendation. [5]. Software availability also has to be looked into both for end use and also for application development.

Experimental and laboratory facilities need to be upgraded to handle advanced and cutting edge research. Presently, most facilities are mainly for undergraduate instruction except centers of excellence such as the Aero, Marine and Automotive Labs. These labs are available for use but the old labs also have to be upgraded to handle projected increase of masters students.

As the program proceeds, we will solicit feedback from former students to see if the program fulfills their needs and find ways to improve the program. Areas of high demand from the industry and academia can also be better served.

4. Outstanding Issues

Of current concern to academics is the shift in thinking from a content-based curriculum to outcome-based learning. This issue of concern is currently being addressed as follows. In this respect, the learning outcomes of this course can be roughly divided into three areas 1) Knowledge and understanding 2) Cognitive skills 3) Practical and professional skills and attributes. In terms of knowledge, students on completing this course is expected to have strong understanding of mathematical methods to the mechanical engineering field, and a good understanding of general principles of design.

In terms of cognitive skills, graduates are expected to be able to select and apply appropriate mathematical methods for modeling and analyzing engineering problems, select and apply appropriate computer-based methods for modeling and analyzing engineering problems, undertake analysis of systems, processes and components requiring engineering solutions, create and design new processes or products through a synthesis of ideas. They should demonstrate good grasp of research methodology, hypothesis setting and testing and selection of the appropriate research tools and techniques.

In terms of practical skills, graduates are able to demonstrate skills in use of appropriate mathematical methods for modeling and analyzing engineering problems, use of test and measurement instruments, experimental work. Use of IT technology, practical testing of design ideas

in laboratory or through simulation with technical analysis and critical evaluation of results, ability to research, access information, process, prepare and present reports using Internet –based resources. They should also be able to have good communication skills, demonstrate good team-working skills and leadership. They should also demonstrate good ethics and dedication to good professional standards.

The course has been running for the last 4 years. In 2002, the course was offered to part-time students mainly employees from industry in the branch campus at Kuala Lumpur City Campus. The response from the part-timers was very encouraging and proved the fact that there is a strong demand from practicing engineers for the need to improve their skills and qualifications in line with rapid technological and economic changes. When some of these students were asked what motivated them to apply for this course, some replied that they wanted a higher qualification for career advancement, some wanted to switch to an academic career after graduation and others required the higher order knowledge to perform their work. To assist their learning process, the part-timers were limited to taking not more than 9 credits per semester and unlike the full timers, they had no limit to the number of provisional passes they might obtain in their exams.

We have had an increasing number of enquiries from prospective students from abroad and some of them have actually joined the course. Through the medium of the School of Post Graduate Studies, some overseas marketing of the course initially in Indonesia, Gulf States and recently Pakistan have been performed and the response has been satisfactory. We intend to increase the number of the overseas students through more intensive and aggressive marketing so that our course at UTM can truly have an international flavor.

Another way we are considering to increase the attractiveness of this course as well as the quality is to seek to tie up the running of this course with a European university partner or partners. Through these ties, fellow academics from a European partner university can come for a brief period, say two weeks, during their summer holidays and present an intensive course on a subject matter that is mutually agreed before hand. The fact that we have a subject called Independent Study allows us to accommodate this in any future joint program because we can offer any relevant and current topic without having to specify it in our curriculum. This intended link will be explored through the offices of the European Union. We feel that this will add further value to the course.

5. Summary

The increased complexity and rapidly changing nature of technology has spurred the growth of graduate education beyond the baccalaureate degree. Recognizing this need and the globalization factor coming into the 21st century, the Faculty of Mechanical Engineering at UTM has designed a Master by Taught Course that offers a strong foundation in mechanical engineering, a broad and flexible field of specialization for the academia, industries and government institutions, and an open approach to learning with its special Independent Study Module.

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