



## **Bachelor of Education (Engineering) Program - The Open University Malaysia Model**

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### ABSTRACT :

This paper gives an overview of the design and development of Bachelor of Education (Civil / Electrical / Mechanical Engineering) programs for delivery through open and distance learning methodology at the Open University Malaysia. Research was carried out extensively prior to the design and development processes. These programs were tailor designed to train in-service teachers attached to the Ministry of Education, Malaysia, and they constitute an integral part of the Ministry's plan to ensure that all technical teachers in Malaysian secondary schools possess tertiary education by the year 2010. This paper focuses on the curriculum development, the learning methodology, the laboratory requirements and planning, the courseware development, the e-learning delivery platform, and on the program quality assurance. Besides these, the academic calendar adopted for the program is also discussed since it has a strong influence on the design of the curriculum and on the duration of this program. The programs were designed and developed to introduce some uniqueness that will ensure academic accreditation and at the same time meet the needs of the intended target group.

### 1. INTRODUCTION :

Open and distance learning (ODL) has played an integral role in shaping and reengineering the mode of teaching and learning in recent years. ODL has gone through a long way of pedagogical and technological change since its initial form of correspondence course that was developed more than a century ago in the late 1800s (Mehrotra, Hollister & McGahey, 2001). Recently, ODL has leveraged on the utilization of information and communication technologies (ICT) in its teaching and learning processes so as to ensure effective and efficient delivery of education to the learners.

This paper gives an overview of the design and development of the Bachelor of Education ( Civil / Electrical / Mechanical Engineering ) degree programs at the Open

University Malaysia and is organized as follows. Section 2 focuses on the aims of these programs. Section 3 focuses on aspects of curriculum development. This is followed by learning and delivery methodology in Section 4. In Section 5, courseware development is reviewed. The E-learning Delivery Platform (ELDP) is discussed in Section 6, followed by program quality assurance in Section 7. Finally, Section 8 summarizes the paper and discusses possible areas for further research.

### 2. AIMS AND PURPOSES :

The Open University Malaysia (OU Malaysia) was established in 2000. Since its first intake in August 2001, the number of learners at OU Malaysia has risen from 753 to over 61,000, and the number of academic

programs from 4 to 51. It currently has 5 academic schools, 6 centres and 1 school to facilitate its teaching and learning processes.

The Faculty of Engineering and Technical Studies (FETS) at OU Malaysia was established with the objective of providing tertiary education and life-long learning opportunities in the engineering and technical fields. In this paper, we will discuss the following three undergraduate degree programs delivered through ODL ;-

- Bachelor of Education (Civil Engineering) with Honours ;
- Bachelor of Education (Electrical Engineering) with Honours ; and
- Bachelor of Education (Mechanical Engineering) with Honours.

The programs were tailor designed to train in-service teachers attached to the Ministry of Education of Malaysia, and it constitutes an integral part of the Ministry's plan to ensure all technical teachers in Malaysian secondary schools possess tertiary education by the year 2010 (Naidu, Muthusamy & Fadzil).

Obtaining a pre-service certificate or diploma qualification in teaching or education from a college or a university does not promise complete and sufficient knowledge in becoming the *perfect* teacher or educator. Raghavan (2002) has quoted that pre-service training is only the first stage of the training process. Furthermore, pre-service teaching or education qualification does not prepare a teacher for lifetime teaching and learning. Therefore, there is a need for continuous learning in the current dynamic and changing world. However, in-service teachers are usually busy with numerous challenges such as work load, family commitments, time and finance which deter their motivation to study for further education. Distance learning has offered hope for these teachers who could not pursue further education on a full-time basis, by providing them with the opportunity to learn and teach at the same time without jeopardizing their family and career.

### 3. CURRICULUM DEVELOPMENT :

Curriculum design and development plays an important role in determining the success of any program delivered via ODL. The program must then formulate a set of program outcomes such as the knowledge, skills and attitudes that will reflect OU Malaysia graduates. Besides its role in facilitating the teaching and learning processes, the curriculum also influences the attraction of learners and their retainability in an ODL system. Fadzil (2002) has quoted that there are three main factors that influences the design of curriculum in an ODL environment, namely, the target group of learners, the expectation on its learners upon graduation and the pre-defined structure of the program's academic calendar. Figure 1 shows the general approach that FETS followed on developing a curriculum especially a tailor made program. There are two key aspects to be noticed - the *student-centred approach* which is a crucial component in distance education, and the *customized requirements* to meet the needs of the Ministry of Education (MOE). Another important component is the reviewing which is done by the External Examiner and the Internal Committee. A periodic course review is carried out to ensure the currency of content, an appropriate usage of technology, the effectiveness of the delivery strategies and the course integration with other courses, as well as updating or redesigning courses to strengthen the entire program.

The target group of learners for these three programs are pre-defined as the in-service teachers attached to the Ministry of Education, Malaysia. Fadzil (2002) has stated that normally the maximum credit loading for ODL students should not be more than 12 credits per semester, and students are also strongly discouraged from registering for more than three subjects per semester. At OU Malaysia, one credit hour is equivalent to 40 hours of learning in any one semester - and these include self-managed learning, on-line learning and attending tutorial sessions.

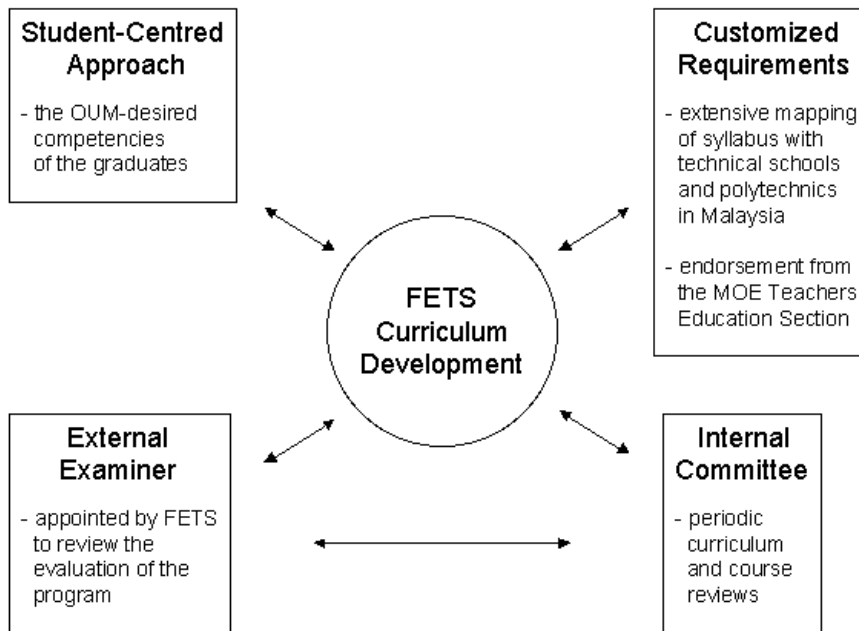


Figure 1 : The OU Malaysia FETS Curriculum Development Model

OU Malaysia adopts a trimester system (January, May and September) which comprises two normal semesters of 15 weeks duration and one short semester (May) of 8 weeks duration. Table 1 summarizes the credit loading and courses for the learners in one academic year based on the structure of this academic calendar. This table also shows that the credit loading for a particular semester is in accordance with the duration of the semester.

All the three programs are uniquely designed to offers courses that combine both the education and the engineering fields. Learners are required to accumulate 120 credit hours in order to graduate. The curriculum focuses on the integration of three main components ;-

- development of the learner’s pedagogical knowledge ;

Table 1 : Credit Loading and Number of Courses in One Academic Year

Semester	Duration	Recommended Number of Credits	Recommended Number of Courses
January	15 weeks	6 to 9	2 or 3
May	8 weeks	3 to 6	1 or 2
September	15 weeks	6 to 9	2 or 3

- enhancement in the learner's teaching and pupil-assessment methodology ; and
- improvement in the learners knowledge in general engineering and specialized engineering (civil/electrical/mechanical) fields.

The integrated approach of the curriculum is designed mainly as a platform for the learners to gain in their confidence with teaching the engineering subjects and to increase the learner's technical and pedagogical skills. Hence, these can be applied in the future to stimulate his / her pupils' intellectual interest in engineering and guide them towards academic success in schools.

The programs mainly comprise of courses each of 3 credits, and as such are more suitable for programs delivered via ODL mode. This credit loading differs from the credit loading per course adopted by public universities in Malaysia which is between 2 and 4 credits. Since OU Malaysia is owned by the eleven public universities in Malaysia, the programs' curriculum have been derived based on the best and proven curriculum of the public universities. Comparisons of a few established universities were conducted to study the content of each course. Furthermore, to ensure the overall quality of the curriculum, the faculty has formed a Board of Studies (BOS) which consists of experienced and established academics from the eleven public universities together with experts from industries as advisors, subject matter experts (SME) and consultants to review and improve the curriculum.

The courses for each program are divided into five categories, namely compulsory LAN courses, compulsory OU Malaysia courses, core education courses, common engineering courses, and specialized engineering courses. Table 2 outlines the overall syllabus of the programs according to the credit loading carried by each category of the courses. On average, a learner could accumulate 24 credits in an academic year, and hence be able to complete his / her degree in a period of about 5 years. This duration is similar to the

duration for completion of a technical bachelor's degree offered via distance learning by the Malaysian public universities.

In conclusion, Table 2 shows that the elements of the curriculum hold a balanced percentage between the core education courses and the common engineering courses. This design is therefore good, particularly for introducing a program which combines engineering with educational knowledge and practice.

#### 4. LEARNING AND DELIVERY METHODOLOGY :

Multi-mode learning approach has been adopted in the learning and delivery of the program with the objective of developing a learning system that is on par or better than the traditional learning method. The four types of learning and delivery methodology utilized in the delivery of the programs are self-managed learning, on-line learning, face-to-face interaction and laboratory sessions. There is also the need for digital libraries to support the learners. These are discussed next.

##### 4.1 Self-Managed Learning :

Learners are provided with specially constructed printed learning modules as the main source of learning material. This requires learners to study independently according to their time availability. The learning modules are creatively constructed to create an interactive and stimulative environment for increasing the learning motivation of the learners. It is also supplemented with problems and solutions, additional reading materials, exercises and assignments.

##### 4.2 Online Learning :

Information and Communications Technology (ICT) tools such as e-mail, chat rooms and bulletin boards are provided to facilitate interaction among learners and instructors. In addition to that, e-learning materials in the form of graphics and interactive multimedia are progressively being developed to enhance the learning

Table 2 : Components of Credit Loading by Category

Category	Components	Total Credit Loading	% Weight
Compulsory LAN Courses	Three 3-credit courses, offered during the short May semester.	9	7.5 %
Compulsory OU Malaysia Courses	Six 3-credit courses, offered during the short May semester.	18	15.0 %
Core Education Courses	Nine 3-credit courses and one 6-credit course, offered during the normal January and September semesters.	33	27.5 %
Common Engineering Courses	Eleven 3-credit courses, offered during the normal January and September semesters.	33	27.5 %
Specialized Engineering Courses	Nine 3-credit courses, offered during the normal January and September semesters.	27	22.5 %
Total		120	100 %

outcomes. The e-learning materials and the communication tools are delivered through the internet via the myLMS e-learning delivery platform.

#### 4.3 Face-to-Face Interactions :

Face-to-face tutorials are conducted by the tutors at OU Malaysia Learning Centres established throughout the country. They are usually held during the weekends, not less than three to five times per semester. Issues related to course materials, assignments and academic counselling are discussed during these tutorials.

#### 4.4 Laboratory Sessions :

Laboratories and practical sessions are important components of engineering education. It is one of the principle ways that engineering students learn how to apply theory (Muthusamy et al., 2005). Therefore, the requirement for the laboratory sessions in these programs is essential especially in

engineering courses. Since OU Malaysia is a consortium of eleven public universities, it has the benefit of utilizing the engineering laboratories of those universities. Also, the laboratories of other technical institutions such as polytechnics and private universities are also utilized. The type of laboratory sessions required for each course can be divided into two main categories. Firstly, the courses that requires the entire learning and instruction to take place in the laboratory i.e. technical drawing. Secondly, the courses that requires specific experiments to be carried out to enhance the learning outcomes apart from the normal tutorial sessions, i.e. thermodynamics, fluid mechanics, and so on. The sessions are at specific engineering laboratories at a particular university or polytechnic during weekends or semester break, and each takes 2 to 4 days according to the requirements. Laboratory manuals are prepared by the subject matter experts (SME).

#### 4.5 Digital Libraries :

Since the learners may be *anyone*, *anywhere* and at *anytime*, traditional library systems are unlikely to be convenient or the preferred mode when in search for resource materials. At OU Malaysia, state of the art digital library services are already available to our learners providing online access to large collections of books, journals, articles, and so on, in engineering and other fields. Additionally, learners have full access to the libraries of the eleven public universities in the OU Malaysia consortium..

#### 5. COURSEWARE DEVELOPMENT :

Courseware is an essential material that plays an enormous role in the delivery and instruction of an ODL program. It acts as the main medium of knowledge transfer from the instructor or the SMEs to the learners. At OU Malaysia, courseware is produced by applying a rigorous system and strict quality control measures that employ systematic and iterative processes. The courseware is produced in the form of specially constructed printed modules and laboratory manuals, and electronically-constructed online graphical and web-based learning materials. The Centre for Instructional Design and Technology (CiDT) is responsible for producing the courseware in cooperation with the academic faculties. CiDT is one of the centres of excellence established within OU Malaysia. It is staffed by dynamic personnel, including a director, project managers, instructional designers, graphic designers, multimedia and web developers, animators, audio and video specialists.

The specially-constructed printed material acts as the main source of learning material to the learners. The production process starts with the pre-writing stage during which the dean and a team of SMEs identify and analyse the need of the particular content for a course, which results in the syllabus of the course. The team of SMEs that are selected to write the course materials are then trained in writing skills for ODL. The selected SMEs are usually experienced and renowned experts

in the field from OU Malaysia or from the Malaysian public or private universities. The writing, moderating and editing stage follows after that. After this stage has been completed satisfactorily, the instructional designers together with development team members will design and develop the print-based and electronic materials. The print-based materials are finally delivered via the learning modules and laboratory manuals, and the electronic material is delivered via the myLMS e-learning delivery platform and via CD-ROMs.

To ensure that the instructional design is suitable for the intended target audience, rigorous formative evaluation in the form of field testing is conducted, and feedback is provided to the instructional designers and SMEs before the final printing or further development. Also a summative evaluation is conducted after the implementation stage to ensure that the content of the courseware is at a satisfactory level.

#### 6. E-LEARNING DELIVERY PLATFORM :

In an ODL platform, the e-learning delivery platform (ELDP) plays an integral part to ensure that the learning materials are delivered to the users in the most effective and efficient manner (Muthusamy & Fadzil, 2005). More (2002) has defined e-learning as a mode of learning where the learning resources are provided electronically. At OU Malaysia, an internally-developed 'my Learning Management System' (myLMS) is used as the ELDP for facilitating the processes of learning and instruction. Learners may access courses after they have registered through 'myCourse' (Figure 2) and this also enables them to access e-learning support material such as Power Point Presentations, Course Contents, Assignments, References, and Forums. Important features of the *Forum* facility consists of *Announcement* and *Online Discussion*. Learners are able to interact with their tutors and fellow learners via the *Online Discussion* facility, through which they may compose questions and hold discussions on a regular basis (Figure 3). Also, tutor-led discussions are also initiated

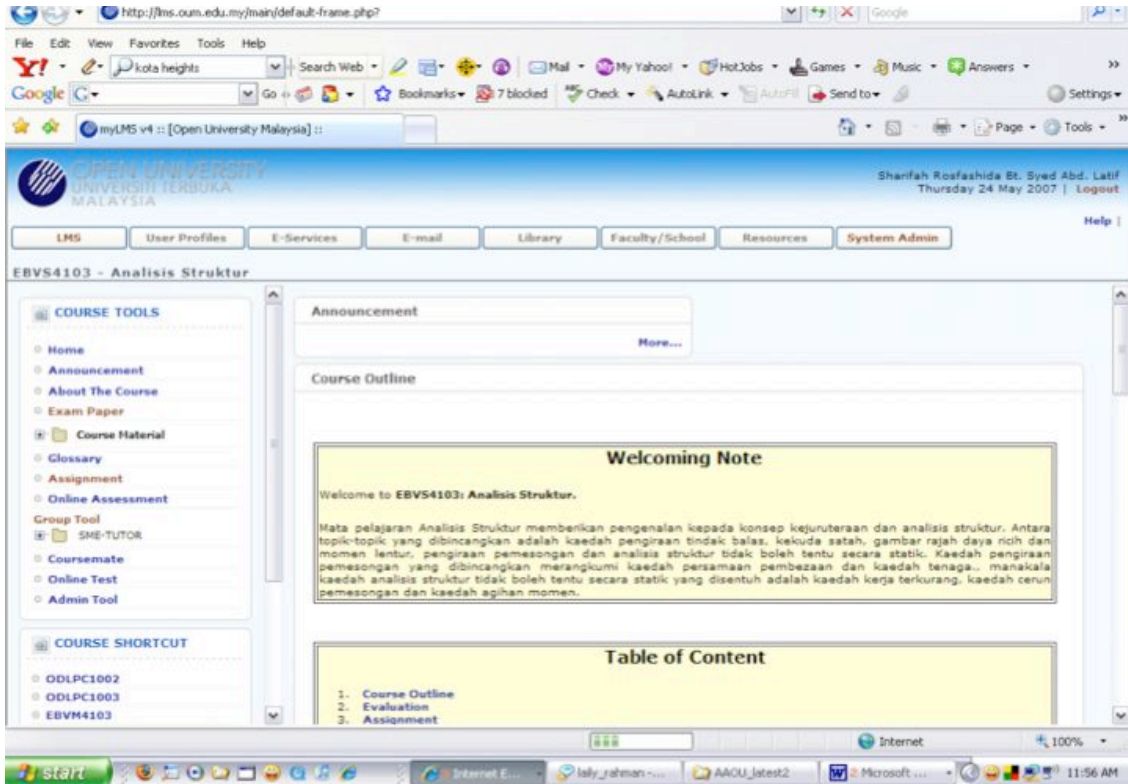


Figure 2 : myLMS myCourse Interface

to facilitate the learning process, thus stimulating the learners participation and collaborative learning. The following is a brief explanation of each of the learning tools in the myLMS ;

- i) *myCourse* is a content management centre where users can access to the courses they registered.
- ii) *myCourse Summary* provides learners with brief information on the course.
- iii) *Announcement* enables e-learning executive or course coordinator to upload the latest announcements related to the course to learners and instructors.
- iv) *Course Content* provides learners the module material in a portable document format (pdf).
- v) *Support Material* provides additional material to the learners, eg power point slides summarising the module, past-year examination questions, etc.
- vi) *Assignment* provides learners with the assignment questions and related materials.
- vii) *Digital Drop Box* is a file sharing facility that allows instructors and learners to share and exchange notes, course materials, and also students to submit assignments.
- viii) *Forum* enables learners and instructors to bring up issues related to the course for discussions. You can pose relevant questions and discuss them on the online forum.
- ix) *Group E-mail* allows the tutor to communicate with all the learners without the need of entering their e-mail addresses.
- x) *Forum Monitoring* allows instructors to monitor each learner's participation in the forum.

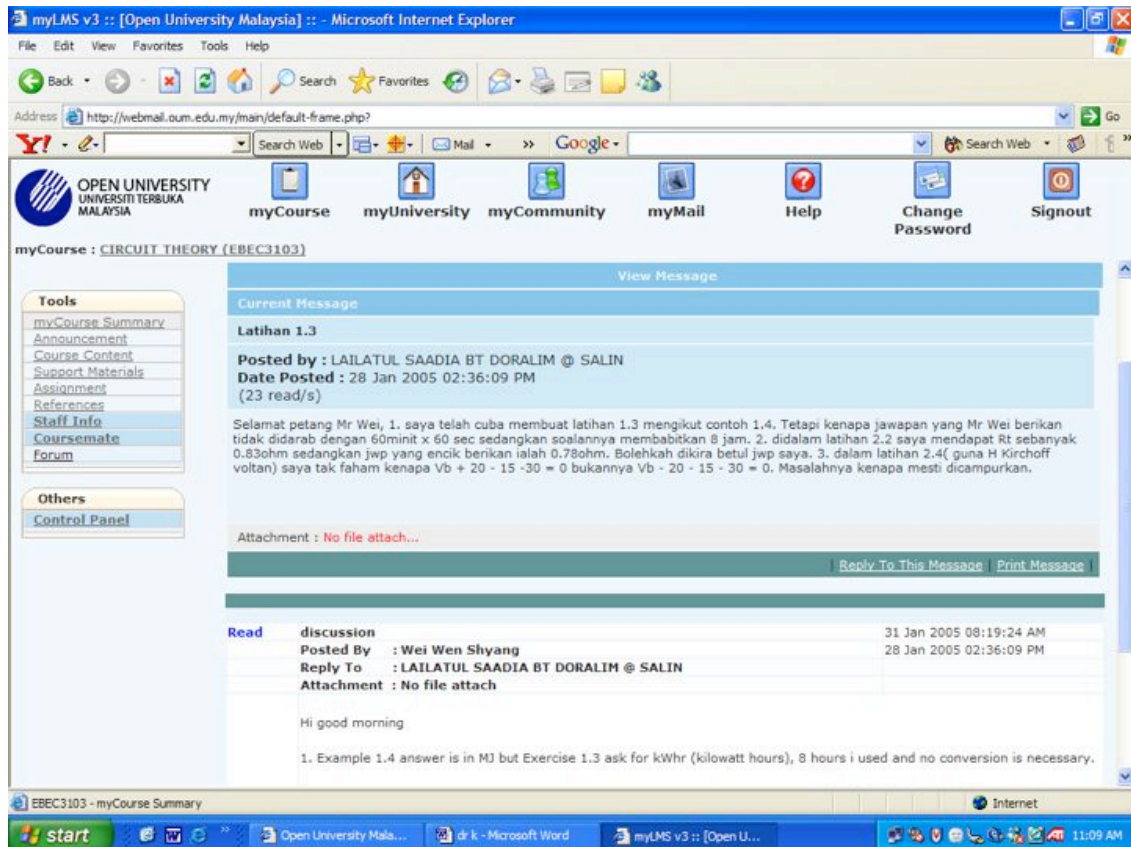


Figure 3 : The myLMS Online Discussion Forums

## 7. QUALITY ASSURANCE AND ACCREDITATION :

Quality assurance in higher education, especially in ODL is a factor that has to be given important consideration in order to ensure the overall quality of the program. It covers a wide range of aspects that have to be addressed specifically. Brennan (1998), as quoted in Mills & Fage (1999), have listed numerous purposes for implementing quality assurance in higher education at the international level ; -

- to ensure accountability of public funds;
- to improve the quality of higher education provision ;
- to inform funding decisions ;
- to inform students and employers ;
- to stimulate competitiveness within and between organisations ;
- to undertake a quality check on new (and sometimes private) institutions ;

- to assign institutional status ;
- to support the transfers of authority between the state and institutions ;
- to assist mobility of students ; and
- to make international comparisons.

OU Malaysia is committed in implementing strict quality assurance measures in the delivery of its program to ensure that the set objectives are achieved. In line with this, the OU Malaysia has established the Centre for Quality Management and Research & Innovation (CQMRI) to promote quality management and quality research in open and distance learning that supports innovation in order to fulfil the mission of the university. This centre is working towards achieving the ISO Certification for the university.

A number of renowned and experienced experts in ODL have been invited to conduct workshops and trainings regularly. The quality assurance processes at the OU Malaysia covers almost all aspects in its



daily operations, such as curriculum development, courseware development, instructors selection and training, teaching and learning processes, examinations, and online resources. These are briefly summarised here ;

#### *Curriculum Development*

All the courses are adapted and improvised from courses conducted by Malaysian public universities. A panel comprising of experienced academicians from the public universities and industries is formed to formulate the curriculum.

#### *Courseware Development*

Experienced academicians from OU Malaysia or invited renowned academics from the Malaysian public and private universities are selected to produce the courseware content. All courseware is enhanced by a team of instructional designers, graphic and multimedia designers, and desktop publishers. High quality printing and output is a requirement for both print-based and electronic-based courseware.

#### *Instructors Selection and Training*

Experienced course instructors are appointed from the public / private universities and industries, and are trained adequately to meet the requirements.

#### *Teaching and Learning Processes*

A special task force is formed to monitor, evaluate, analyse and improve progress in the teaching and learning processes.

#### *Examinations*

Examination questions are prepared by SMEs and moderated by external moderators. The marking of the examinations is carried out by the SMEs under the supervision of the faculty dean.

#### *Online Resources*

Information in the subject matter, and on the website, is frequently updated.

#### *Accreditation*

In Malaysia, programs provided by the higher learning institutions are required to

go for accreditation by the National Accreditation Board (LAN). With continuous and persistence improvements, all the three programs were successfully evaluated and accredited by the LAN in 2006 last year.

## 8. CONCLUSION :

In general, all the three programs have been designed and developed to introduce special uniqueness that will enable them to be academically acceptable and at the same time meet the needs of its main target group. Improvement and new ideas are being introduced from time to time to make the programs more user-friendly while at the same time maintaining their quality and acceptability. All the three programs were successfully accredited by the authorities. The lessons learned in developing these programs are being applied to our new programs.

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