PROGRAMME STANDARDS:

ENGINEERING AND ENGINEERING TECHNOLOGY

STANDARD PROGRAM:

KEJURUTERAAN DAN TEKNOLOGI KEJURUTERAAN

Covering all fields of study within engineering and engineering technology, the standards is designed to encourage diversity that is compatible with the national and global human resourse requrements and socio-economic needs.

Merangkumi kesemua bidang kejuruteraan dan teknologi kejuruteraan, standard ini direka bentuk bagi menggalakkan pelbagai pedekatan yang sesuai dengan keperluan sosio-ekonomi dan masyarakat umum.

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Malaysian Qualifications Agency
Tingkat 14B, Menara PKNS-PJ
No 17, Jalan Yong Shook Lin
46050 Petaling Jaya
Selangor Darul Ehsan

Tel +6003-7968 7002
Fax +6003-7956 9496
Email akreditasi@mqa.gov.my
URL www.mqa.gov.my

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FOREWORD

In its effort to ensure the quality of programmes in institutions of higher learning in Malaysia, Malaysian Qualifications Agency (MQA) has published various documents such as Malaysian Qualifications Framework (MQF), Code of Practice for Programme Accreditation (COPPA), Code of Practice for Institutional Audit (COPIA), Guidelines to Good Practices (GGP) and Programme Standards (PS). It is important that these quality assurance documents be read together with this document in developing and delivering higher education programmes in Malaysia.

The Programme Standards document outlines sets of characteristics that describe and represent guidelines on the minimum levels of acceptable practices that cover all the nine Malaysian quality assurance areas: programme aims and learning outcomes, curriculum design and delivery, assessment of students, student selection, academic staff, educational resources, programme monitoring and review, leadership, governance and administration, and continual quality improvement.

The Programme Standards for Engineering and Engineering Technology cover all the education levels: from certificate to doctoral. They, however, do not cover the Bachelor of Engineering programmes which are accredited by the Board of Engineers Malaysia (BEM), and for which reference is to be made to the Engineering Accreditation Council (EAC) Manual.

This Programme Standards document has been developed by a panel of experts in consultation with various public and private Higher Education Providers (HEPs), relevant government and statutory agencies, professional bodies, related Engineering and Engineering Technology industry and students. For international benchmarking, the panels have also made references to the Dublin and Sydney Accords.

As the existing and evolving fields of engineering and engineering technologies are diverse, these standards do not attempt to give specific characteristics for the programmes, especially for those related to the framing of the curricula and provision of educational resources. This Programme Standards document encourages diversity and allows programme providers to be innovative and to be able to customise their programmes in order to create their own niches, while ensuring they produce graduates that meet the current needs of the profession and ensuring they fulfil their obligations to society. Some examples given in this Programme Standards document, such as the statements of programme aims and learning outcomes, are intended to give clarity to the document; they are not intended to be adopted in a verbatim manner.

I would like to express my appreciation to all the panel members, the various stakeholders who have given their input, and all the officers from MQA who have contributed to the development of this Programme Standards: Engineering and Engineering Technology document.

Thank You.

Tan Sri Dato' Dr. Mohamed Salleh Mohamed Yasin
Council Chairman
Malaysian Qualifications Agency (MQA)
2011

ACKNOWLEDGEMENT

The completion of this document, **The Programme Standards: Engineering and Engineering Technology** was largely due to the support of outstanding individuals from Institutions of Higher Education, Industries and Government agencies. These experts, who come from different backgrounds, worked meticulously over a period of nine months to produce this final document.

Malaysian Qualifications Agency would like to thank the following experts for their support and contribution towards the production of this Programme Standards document.

No.	Panel Members	Organisation
1.	Abas Abdul Wahab (Professor Ir. Dr.)	Universiti Tun Hussein Onn Malaysia (UTHM)
2.	Lai Ah Ying (Ir.)	Federation of Malaysian Manufacturers (FMM)
3.	Marlinda Abdul Malek (Associate Professor Ir. Dr.)	Universiti Tenaga Nasional (UNITEN)
4.	Michael King (Dr.)	United Engineers (Malaysia) Berhad (UEM)
5.	Mohamed Ibrahim Abdul Mutalib (Associate Professor Dr.)	Universiti Teknologi PETRONAS (UTP)
6.	Mohd Fauzi Abdul Rahman (Mr.)	German-Malaysian Institute (GMI)
7.	Mohd. Marzuki Mustafa (Professor Ir. Dr.)	Universiti Kebangsaan Malaysia (UKM)
8.	Musa Mailah (Professor Dr.)	Universiti Teknologi Malaysia (UTM)
9.	Noor Azizan Itam (Mr.)	Department of Polytechnic Education Ministry of Higher Education (MoHE)
10.	Shahrul Ahmad Shah (Mr.)	UNIKL Malaysian Institute of Aviation Technology (UNIKL MIAT)
11.	Siva Jothi (Mr.)	KDU College Sdn. Bhd. (Petaling Jaya Campus)

No.	Panel Members	Organisation
12.	Suhaimi Abdul Talib (Professor Ir. Dr. Sr.)	Engineering Accreditation Council (EAC)
13.	Tony Wilson (Associate Professor Dr.)	The University of Nottingham (Malaysia Campus)
14.	Rozilini Mary Fernandez-Chung (Dr.) (Ed.)	Malaysian Qualifications Agency (MQA)

Within this agency, the creative process was assisted by Mrs. Fazliana Mohamed who may be contacted at fazliana@mqa.gov.my for any clarification or query.

With our sincere appreciation and gratitude,

Dato' Dr. Syed Ahmad Hussein

Chief Executive Officer

Malaysian Qualifications Agency (MQA)

2011

A NOTE FROM THE CHAIRPERSON

As part of the initiatives to support MQA's mission in building confidence through quality assurance of academic programmes in Malaysia, a panel of experts was appointed from experts from public and private HEPs, the Ministry of Higher Education (MOHE) and practitioners to develop the Programme Standards: Engineering and Engineering Technology document.

In developing the Programme Standards, the panel members have made references to existing practices among the local public and private HEPs. To ensure that these standards are at par with international practices, certain programme learning outcomes were adopted from the Dublin and Sydney Accords, which are international agreements for the mutual recognition of qualifications in the fields of engineering and engineering technology. This was also done to facilitate membership to these international accords if Malaysia decides to be a member of these accords in future.

The panel took cognisance of the fact that while these Programme Standards need to prescribe a set of minimum criteria to ensure consistency in the quality of programmes offered by the various HEPs, the Programme Standards should also encourage diversity and innovation. This will allow the HEPs to craft their own niches to meet the dynamics of the targeted employment markets and to meet the needs of society.

The minimum criteria set in the Programme Standards are based on what is considered the minimum level that should be attained by the HEPs to ensure a programme can be adequately delivered. This, however, does not imply that the HEPs should ultimately aim to satisfy these minimum criteria. Instead they should strive for continual quality improvement.

We have managed to develop this Programme Standards document because of the contribution of all panel members and various stakeholders. I am truly honoured to have the opportunity to work with this team of panel members and the officers from MQA. I would like to express my sincere gratitude and appreciation to them for their commitment and dedication in preparing this Programme Standards document.

Professor Ir. Dr. Mohd. Marzuki Mustafa

Chairperson

Programme Standards: Engineering and Engineering Technology

Malaysian Qualifications Agency (MQA)

2011

ABBREVIATIONS

ABE	Association of Building Engineers
ASME	American Society of Mechanical Engineers
BEM	Board of Engineers Malaysia
BS	British Standards
CGPA	Cumulative Grade Point Average
CPD	Continuous Professional Development
COPIA	Code of Practice for Institutional Audit
COPPA	Code of Practice for Programme Accreditation
DIN	Deutsches Institut fur Normung
EAC	Engineering Accreditation Council
GGP	Guidelines to Good Practices
HEP	Higher Education Provider
IELTS	International English Language Testing System
IHL	Institution of Higher Learning
JIS	Japanese Industrial Standards
MOHE	Ministry of Higher Education
MQA	Malaysian Qualifications Agency
MQF	Malaysian Qualifications Framework
MUET	Malaysian University English Test
NIOSH	National Institute of Occupational Safety and Health
OBE	Outcome-Based Education
OSHA	Occupational Safety and Health Act
PBL	Problem-Based Learning
PS	Programme Standards
SIRIM	Standards and Industrial Research Institute of Malaysia
SLT	Student Learning Time
SPM	Sijil Pelajaran Malaysia (Malaysia Certificate of Education)
STPM	Sijil Tinggi Persekolahan Malaysia (Malaysia Higher School Certificate)
TOEFL	Test of English as a Foreign Language

GLOSSARY

1)	Common Core	Modules that are deemed common to all disciplines of Engineering and Engineering Technology by these Programme Standards.
2)	Credit	A quantitative measurement that represents the learning volume or the academic load to achieve the respective learning outcomes.
3)	Discipline Core	Specific modules to a specific discipline of Engineering and Engineering Technology by these Programme Standards.
4)	Industrial training/ Industrial Attachment/ Internship	A period of time within the programme during which the students are required to be placed in the industry to gain industrial experience and to enhance their soft skills.
5)	Learning Outcomes	Statements on what a student is expected to know, understand and do upon the completion of a period of study.
6)	Programme Aims	Overarching statements on the purpose, philosophy and rationale of the programme.
7)	Student Learning Time	A period of time that a student should spend on the learning-teaching activities for a given credit which comprises guided learning, independent learning and assessment.
8)	Viva Voce	An oral examination which test a student's communication skills and knowledge of relevant facts.

INTRODUCTION

Engineering is a discipline that applies principles of sciences and mathematics in providing products and services that shape and influence the way society lives. Advances in engineering have led to improved quality of life for the global population. Today and in the future, engineers, technologists and technicians are expected to focus their efforts on ensuring that engineered products, processes, services and technologies are based on sustainable development principles. Thus the training of future engineers, engineering technologists and technicians must focus on solving both common and complex problems. This requires a curriculum that has a strong focus on the fundamentals of mathematics, sciences and engineering. In addition, the training must incorporate elements of lifelong learning skills that will enable graduates to continue enhancing their knowledge and skills.

This Programme Standards document provides a guide for all levels of engineering and engineering technology programmes certifications, with the exception of the Bachelor's Degree in Engineering, for which reference is made to the Engineering Accreditation Council (EAC) Manual. This is consistent with Section 50 (4) of the Malaysian Qualifications Agency (MQA) Act, 2007 which stipulates that the Agency should consult a Joint Technical Committee, in this case, the EAC established by the Board of Engineers Malaysia (BEM). Graduates from a four-year engineering programme accredited by the EAC qualify for registration as graduate engineers with the BEM.

However, in relation to the Bachelor's Degree in Engineering, MQA acknowledges the presence of foreign engineering programmes in Malaysia conducted over a period of three years. While the HEPs are free to maintain the practices of their parent campuses, the running of such programmes must comply with the existing MQA policies pertaining to the offer of foreign degrees in Malaysia. With these conditions, a three-year foreign engineering programme may be offered. However, the HEPs are obligated to provide this information and that regarding pathways, such as a top-up programmes or MEng Degrees towards recognised qualifications leading to professional recognition or registration, to potential students.

This Programme Standards document covers all fields of study within engineering and engineering technology and is developed to ensure graduates meet the professional requirements and expectations in their respective fields. It is designed to encourage diversity in approaches within a framework that is compatible with the national and global human resource requirements and socio-economic needs. This Programme Standards cannot be seen as a syllabus and no form of prescription is intended in the amount of time devoted to each component or the order in which the material is taught. HEPs are expected to organise, teach and assess the subject matter creatively and innovatively. The Programme Standards provide an inventory of content, delivery and assessment of programmes, thus enabling identification of vital components of qualifications related to engineering and engineering technology. Engineering and engineering technology academic pathways are developed to take into consideration the current needs of the profession.

These Programme Standards provide a generic guideline for all levels of engineering and engineering technology academic qualifications except for the Bachelor's Degree in Engineering as illustrated

in **Appendix 1**. For the Bachelor's Degree in Engineering, reference should be made to the EAC Manual. As it is not possible to provide a detailed breakdown on the structures of the numerous subfields, this Programme Standards document provides generic guidelines for the qualifications in conventional engineering and engineering technology programmes at various levels of the Malaysian Qualifications Framework (MQF). Nomenclatures may also vary according to the needs of the fields and specialisations. This document does not prescribe the nomenclatures but rather proposes some good practices in specifying nomenclatures locally and internationally as shown in **Appendix 2**.

HEPs must take into consideration the rapidly evolving subject matter and introduce effective and sustainable programme improvement. In doing so, the providers should ensure the graduates obtain necessary skills to function effectively as professionals and members of the society.

As the purpose of this Programme Standards document is to provide guidelines in relation to the development and conduct of programmes in the identified fields, it is important that this document be read with other quality assurance documents and policies by the Malaysian Qualifications Agency and related agencies, such as:

1. The Malaysian Qualifications Framework (MQF)
2. The Code of Practice for Programme Accreditation (COPPA)
3. The Code of Practice for Institutional Audit (COPIA)
4. Relevant Guidelines to Good Practices (GGP)

The following paragraphs present a brief description of the engineering and engineering technology fields of study, their sub-disciplines and their respective career opportunities.

ENGINEERING

Engineering is the discipline or profession of acquiring and creatively applying knowledge of science and mathematics coupled with the use of natural laws and earth resources in the design of products, processes or systems that enhance the living standards and quality of life. Engineers seek solutions or designs that balance the need for the development of a built environment and the need to protect the natural environment. Engineers provide engineering products, processes and systems that are safe, effective, economical and sustainable.

Engineering training in Malaysia can be categorised into several levels of study, namely, Certificate, Diploma, and Bachelor's, Master's and Doctoral Degrees. At each of these levels, the engineering programmes can be divided into several sub-disciplines such as Civil, Chemical, Mechanical, and Electrical and Electronics. This Programme Standards document outlines the minimum requirements that must be satisfied by the HEPs in designing curricula, admitting students, recruiting suitable academic staff, providing the necessary infrastructure and resources, and having a sound quality management system. Emphasis is given to the Outcome-Based Education (OBE) in the training of students at all levels of qualification.

Civil engineering is the broadest and oldest of the engineering fields. It is a discipline that deals with the design, construction, operation and maintenance of the built environment that encompasses infrastructure such as buildings, bridges, roads, canals, dams, water supply and wastewater services facilities. It is traditionally categorised into environmental engineering, geotechnical engineering, structural engineering, transportation engineering, municipal or urban engineering, water resources engineering, materials engineering, coastal engineering, surveying, and construction engineering. The challenges in civil engineering involve making the most effective and efficient use of natural resources in providing these facilities that constitute the built environment and to ensure that the built environment co-exist with the natural environment in a sustainable manner.

Graduates with qualifications related to the various levels of engineering certifications may be employed either in the public or private sectors. In the public sector, graduates are engaged to either design engineering facilities; supervise construction projects on behalf of the government or be involved in operating and maintaining public infrastructure facilities. In the private sector, they can be employed by consulting practices, contractors or private developers. In addition to these, graduates with Master's and Doctoral Degrees would also have the opportunity to pursue their careers with academic or research institutions.

Chemical engineering is the application of science, in particular chemistry, physics and mathematics, to the process of converting raw materials or chemicals into more useful or valuable products. It is the discipline of engineering that largely involves the design and operation of chemical processes. Nowadays, the discipline of chemical engineering has grown to also include biochemical processes such as food processing and pharmaceuticals where the application of biology is required.

Chemical engineers work in a variety of manufacturing industries such as chemical, petrochemical, food, energy and semiconductor industries. They can also be employed in service industries such as health care, business services and consultancies. With the current significant progress in biotechnology and nanotechnology, there are already increasing employment opportunities for chemical engineers to work in these fields.

Mechanical engineering is one of the oldest and broadest areas of engineering activity. It involves the application of principles of physics for analysis, design, manufacturing and maintenance of mechanical systems. It requires a solid understanding of core concepts including applied mechanics, thermo-fluids, engineering design and instrumentation and control.

Graduates in Mechanical engineering combine the basic knowledge of physical sciences and engineering education with experience and expertise to invent, design and manufacture, run and maintain mechanical equipment, machinery and tools in all branches of industry including automotive, aerospace, marine/shipbuilding, manufacturing and processing. They may further their careers as product designers, building contractors, manufacturers of machines or engineering products, administrators or managers, researchers in Research and Development (R&D) units or

academicians in institutions of higher learning.

Electrical engineering is the field of study which deals with the technology of harnessing electrical energy towards designing, testing and development of circuitry and equipment for electrical transmission systems, machine control and high power apparatus and systems. Generally, electrical engineering encompasses electrical power and control, electronic, telecommunication and computer systems.

Electrical engineers find career opportunities with utilities companies, various manufacturing companies, consulting services and in the electronic design and development sector. They are responsible for the generation, transfer and conversion of electrical power. They also utilize modern technology to harness energy from alternative resources, such as wind and solar.

Electronic engineering is another branch of engineering that deals with the practical application of designing, fabrication and operations of electronic circuits, electronic devices, broadcast and communication systems, biomedical equipment and medical imaging which operates at low voltage sources as part of its driving force.

Graduates in electronic engineering are employed in technological sectors related to the transfer of information using radio waves, radar and navigational systems, the design of electronic circuits, the design of microprocessor-based computer systems and the development of control systems such as aircraft autopilots and automotive systems.

ENGINEERING TECHNOLOGY

Engineering Technology is that part of the technological field that requires the application of scientific and engineering knowledge and methods combined with technical skills in support of engineering activities.

Technology has been evolving ever rapidly with time in line with market demand. Technology education has also evolved and is very much subjected to the demand of the industry. Engineering technology programmes are oriented toward application, and provide their students with mathematics and science courses and a qualitative introduction to engineering fundamentals and applied sciences. Students are exposed to almost similar courses of those of the engineering curricula but which vary in the distribution of theories and hands-on skills. In other words, their areas of interest in education are typically application-oriented, and are somewhat less theoretical and contain fewer mathematical elements than their other engineering counterparts.

Engineering technologists play key roles in areas related to the technologies supporting a particular industry sector, such as air conditioning and refrigeration, aviation, biomedical and transportation.

The term 'technology' is used in the singular, and should be understood to also mean a group of technologies supporting an industry sector.

Engineering technology graduates are often hired to work as engineering technologists in various sectors such as product design, testing and development, systems engineering, field engineering, technical operations and quality control. Some engineering technology qualifications include an emphasis on technical management in addition to the fundamental knowledge in a particular area of technology. Technical management is seen as an appropriate field of specialisation in itself, and many technologists build their career paths in this direction. Examples of such specialisation include product development management, manufacturing management, aviation management, and management and maintenance of processing plants, building services or testing laboratories.

This introduction does not cover in detail all fields of engineering technology, due to its wide range of technical specialisation within the technology spectrum.

PROGRAMME AIMS

"A programme's stated aims reflect what it wants the learner to achieve. It is crucial for these aims to be expressed explicitly and be made known to learners and other stakeholders alike" (COPPA, 2008, pp.10).

"Programme Objectives are specific goals consistent with the mission and vision of the IHL, that are responsive to the expressed interest of programme stakeholders, describing the expected achievements of graduates in their career and professional life a few years after graduation" (Engineering Programme Accreditation Manual, 2007, pp.2).

CERTIFICATE in Engineering / Engineering Technology

The programme aims to prepare graduates who possess basic engineering knowledge and hands-on skills with the capability to work in teams to support operation and maintenance activities within the industrial context.

DIPLOMA in Engineering

The programme aims to prepare graduates who possess a command of engineering knowledge and hands-on skills required to undertake supervision of a team and troubleshooting in both operation and maintenance within the industrial context.

DIPLOMA in Engineering Technology

The programme aims to prepare graduates who possess technical knowledge and associated hands-on skills with the ability to apply them in a specific industrial context.

BACHELOR'S DEGREE in Engineering

The programme aims to provide graduates with a broad-based educational background and skills which equip them with abilities in design and providing solutions to complex and multi-faceted engineering problems.

Note: Accreditation of a four (4) year Bachelor's Degree in Engineering is in consultation with the Engineering Accreditation Council (EAC). Further guidelines can be obtained from the EAC manual at www.eac.org.my / www.bem.org.my.

BACHELOR'S DEGREE in Engineering Technology

The programme aims to prepare graduates who possess a broad technical knowledge and associated hands-on skills with the ability to select, review, refine and implement appropriate solutions within a specific engineering industry context.

MASTER'S DEGREE

The programme aims to provide graduates with the advanced knowledge and capabilities to deal with complex engineering problems.

The three engineering master's programme structures are the full-taught course, mixed mode and full research. The aims of this level of programme are to provide graduates with the advanced knowledge and ability to carry out research and solve problems effectively in their respective fields.

DOCTORAL DEGREE

The programme aims to provide graduates with the ability to carry out advanced research in their fields and solve complex problems. At the same time, it aims to facilitate discovery and contribute to new knowledge.

LEARNING OUTCOMES

"The quality of a programme is ultimately assessed by the ability of the learner to carry out their expected roles and responsibilities in society. This requires the programme to have a clear statement of the learning outcomes to be achieved by the learner" (COPPA, 2008, pp.11).

"These learning outcomes should cumulatively reflect the eight (8) domains of learning outcomes, which are significant for Malaysia" (MQF, 2007, pp.4).

CERTIFICATE in Engineering / Engineering Technology

At the end of the programme, graduates should be able to (**adapted from the Dublin Accord**):

i. apply basic knowledge of mathematics, science and engineering fundamentals to routine procedures and practices in specific fields;

ii. identify specific engineering problems in their discipline with respect to operation and maintenance;

iii. assist in the investigations and design of solutions for specific engineering systems;

iv. demonstrate as awareness of societal, health, safety, legal and cultural issues and the consequent responsibilities;

v. demonstrate communication and team skills;

vi. demonstrate an understanding of ethics, responsibilities and norms of engineering practices;

vii. demonstrate an awareness of management, business practices, entrepreneurship and sustainable development; and

viii. recognise the need for career development and to engage in lifelong learning.

DIPLOMA in Engineering

At the end of the programme, graduates should be able to (**adapted from the Dublin Accord**):

i. apply knowledge of mathematics, science and engineering fundamentals to well-defined engineering procedures and practices;

ii. analyse well-defined engineering problems in their discipline with respect to operation and maintenance, including troubleshooting;

iii. conduct investigations and assist in the design of solutions for engineering systems;

iv. apply appropriate techniques, resources, and engineering tools to well-defined engineering activities, with an awareness of the limitations;

v. demonstrate an awareness of and consideration for societal, health, safety, legal and cultural issues and their consequent responsibilities;

vi. communicate effectively with the engineering community and society at large;

vii. function effectively in a diverse technical team;

viii. demonstrate an understanding of professional ethics, responsibilities and norms of engineering practices;

ix. demonstrate an awareness of management, business practices and entrepreneurship;

x. demonstrate an understanding of the impact of engineering practices, taking into account the need for sustainable development; and

xi. recognise the need for professional development and to engage in independent and lifelong learning.

DIPLOMA in Engineering Technology

At the end of the programme, graduates should be able to (**adapted from the Dublin Accord**):

i. apply knowledge of mathematics, science, engineering fundamentals and engineering specialisation principles to well-defined practical procedures and practices;

ii. analyse well-defined engineering problems in their discipline or area of specialisation;

iii. formulate solutions to well-defined technical problems;

iv. assist in the formulation of systems, components or processes to meet specified needs;

v. conduct investigations of well-defined problems;

vi. apply appropriate techniques, resources, and engineering tools to well-defined engineering activities, with an awareness of their limitations;

vii. demonstrate an awareness of and consideration for societal, health, safety, legal and cultural issues and their consequent responsibilities;

viii. communicate effectively with the engineering community and society at large;

ix. function effectively in a diverse technical team;

x. demonstrate an understanding of professional ethics, responsibilities and norms of engineering technology practices;

xi. demonstrate an awareness of management, business practices and entrepreneurship;

xii. demonstrate an understanding of the impact of engineering practices, taking into account the need for sustainable development; and

xiii. recognise the need for professional development and to engage in independent and lifelong learning.

BACHELOR'S DEGREE in Engineering

Note: Accreditation of a four (4) year Bachelor's Degree in Engineering is in consultation with the Engineering Accreditation Council (EAC). Further guidelines can be obtained from the EAC manual at www.eac.org.my / www.bem.org.my.

BACHELOR'S DEGREE in Engineering Technology

At the end of the programme, graduates should be able to (**adapted from the Sydney Accord**):

i. apply knowledge of mathematics, science, engineering fundamentals and engineering specialisation principles to defined and applied engineering procedures, processes, systems or methodologies;

ii. solve broadly-defined engineering problems systematically to reach substantiated conclusions, using tools and techniques appropriate to their discipline or area of specialisation;

iii. design solutions for broadly-defined engineering technology problems, and to design systems, components or processes to meet specified needs with appropriate consideration for public health and safety, as well as cultural, societal, environmental and sustainability concerns;

iv. plan and conduct experimental investigations of broadly-defined problems, using data from relevant sources;

v. select and apply appropriate techniques, resources and modern engineering tools, with an understanding of their limitations;

vi. function effectively as individuals, and as members or leaders in diverse technical teams;

vii. communicate effectively with the engineering community and society at large;

viii. demonstrate an awareness of and consideration for societal, health, safety, legal and cultural issues and their consequent responsibilities;

ix. demonstrate an understanding of professional ethics, responsibilities and norms of engineering technology practices;

x. demonstrate an awareness of management, business practices and entrepreneurship;

xi. demonstrate an understanding of the impact of engineering practices, taking into account the need for sustainable development; and

xii. recognise the need for professional development and to engage in independent and lifelong learning.

MASTER'S DEGREE

At the end of the programme, graduates should be able to:

i. demonstrate continuing and advanced knowledge and have the capabilities to further develop or use these in new situations or multi-disciplinary contexts;

ii. analyse and evaluate problems in the discipline critically particularly in situations with limited information and to provide solutions through the application of appropriate tools and techniques;

iii. appraise available information and research evidence and apply it in the engineering context;

iv. plan and perform research undertakings professionally, ethically and responsibly;

v. report technical findings in both written and oral forms; and

vi. recognise the needs for continuing professional development.

DOCTORAL DEGREE

At the end of the programme, graduates should be able to:

i. demonstrate an in-depth scholarship of their area of research;

ii. contribute to original research to broaden the boundary of knowledge through thesis or dissertation;

iii. make critical analysis, evaluation and synthesis of new ideas;

iv. plan and perform independent research undertakings professionally, ethically and responsibly and to lead/supervise research projects;

v. report research findings to peers at levels suitable for international publications; and

vi. recognise the needs for continuing professional development.

CURRICULUM DESIGN AND DELIVERY

For the purpose of this Programme Standards document, reference is made to the Code of Practice for Programme Accreditation (COPPA) and in particular, the section on Area 2: Curriculum Design and Delivery.

"The term 'curriculum design and delivery' is used interchangeably with the term 'programme design and delivery'. 'Programme' means an arrangement of courses that are structured for a specified duration and the learning volume to achieve the stated learning outcomes to lead to an award of a qualification" (COPPA, 2008, pp.12).

The delivery of the curriculum is vital in ensuring the achievement of the learning outcomes. **Appendix 3** provides a description of this.

This section of the Programme Standards contains benchmarked statements pertaining to the structure and delivery of a programme within the specific fields of:

i. Engineering; and

ii. Engineering Technology.

The following tables show the benchmark requirements for all levels of qualifications and they include the requirements for the various modules (e.g. common, core and electives). Specific requirements in the body of knowledge for the different levels (Certificate – Doctoral Degree) and disciplines are also provided in the tables.

The credit unit used in this document is based on the Student Learning Time (SLT) as defined in the MQF. The definition of the SLT and its differences with the conventional credits can be found in **Appendix 4**.

TABLE 1:

CERTIFICATE in Engineering / Engineering Technology		
Minimum Graduating Credits – 60		
	Body of Knowledge	Credits*
COMPULSORY MODULES		
I. National Requirement	Bahasa Melayu, Malaysian Studies, Islamic / Moral Studies.	9 – 15
II. HEPs Requirement	Social Science / Humanities Options, Co-Curriculum.	
III. Personal Development	Languages, Communication Skills – Presentations.	
CORE MODULES		

	Body of Knowledge	Credits*
I. Common Core	i. Mathematics ii. Sciences iii. Professional Development Modules which include topics such as Work Ethics, Sustainable Issues and Entrepreneurship.	9 – 12
II. Discipline Core	To be determined by the institutions according to the needs of the programme.	27 – 32
INDUSTRIAL TRAINING		
	Attachment to a relevant workplace.	4 – 12

*Credits calculated are based on the Minimum Graduating Credits stated above.

TABLE 2:

DIPLOMA in Engineering

Minimum Graduating Credits – 90

	Body of Knowledge	Credits*
COMPULSORY MODULES		
I. National Requirement	Bahasa Melayu, Malaysian Studies, Islamic / Moral Studies.	9 – 15
II. HEPs Requirement	Social Science / Humanities Options, Co-Curriculum.	
III. Personal Development	Languages, Communication Skills – Presentations.	
CORE MODULES		
I. Common Core	i. Mathematics ii. Sciences iii. Professional Development Modules which include topics such as Work Ethics, Sustainable Issues and Entrepreneurship.	9 – 22
II. Discipline Core	To be determined by the institutions according to the needs of the programme.	47 – 53 (inclusive of Final Year Project)
INDUSTRIAL TRAINING		
	Attachment to a relevant workplace.	4 – 12
ELECTIVE MODULES		
	-	0 – 9

*Credits calculated are based on the Minimum Graduating Credits stated above.

TABLE 3:

DIPLOMA in Engineering Technology

Minimum Graduating Credits – 90

	Body of Knowledge	Credits*
COMPULSORY MODULES		
I. National Requirement	Bahasa Melayu, Malaysian Studies, Islamic / Moral Studies.	9 – 15
II. HEPs Requirement	Social Science / Humanities Options, Co-Curriculum.	
III. Personal Development	Languages, Communication Skills – Presentations.	
CORE MODULES		
I. Common Core	i. Mathematics ii. Sciences iii. Professional Development Modules which include topics such as Work Ethics, Sustainable Issues and Entrepreneurship.	9 – 22
II. Discipline Core	To be determined by the institutions according to the needs of the programme.	36 – 50 (60% of which must be practical hours)
	Final Year Project	4 – 6
INDUSTRIAL TRAINING		
	Attachment to a relevant workplace.	8 – 12
ELECTIVE MODULES		
	-	0 – 9

*Credits calculated are based on the Minimum Graduating Credits stated above.

BACHELOR'S DEGREE in
Civil / Chemical / Mechanical / Electrical & Electronics Engineering

Note: Accreditation of a four (4) year Bachelor's Degree in Engineering is in consultation with the Engineering Accreditation Council (EAC). Further guidelines can be obtained from the EAC manual at www.eac.org.my / www.bem.org.my.

TABLE 4:

BACHELOR'S DEGREE in Engineering Technology **Minimum Graduating Credits – 140**		
	Body of Knowledge	Credits*
COMPULSORY MODULES		
I. National Requirement	Bahasa Melayu, Malaysian Studies, Islamic/Moral Studies.	17 – 21
II. HEPs Requirement	Social Science / Humanities Options, Co-Curriculum.	
III. Personal Development	Languages, Communication Skills – Presentations.	
CORE MODULES		
I. Common Core	i. Mathematics ii. Sciences iii. Professional Development Modules which include topics such as Work Ethics, Sustainable Issues and Entrepreneurship.	15 – 21
II. Discipline Core (inclusive of a Final Year Project of 8 – 10 credits)	To be determined by the institutions according to the needs of the programme.	80 – 84 (50% of which must be practical hours)
INDUSTRIAL TRAINING		
	Attachment to a relevant workplace.	8 – 12
ELECTIVE MODULES		
	-	8 – 14

*Credits calculated are based on the Minimum Graduating Credits stated above.

Note:

With the conventional credit-hour system based on contact time, higher credit hours implied that students had learned more. This is no longer true with the credit-hour system based on student learning time. The delivery method and learning activities designed for the course have a much bigger influence on the credit hours. A course delivered mainly through lectures and self study would result in lower credit hours compared to that being delivered through lectures and reinforced with formal hands-on activities and self study. As such, one can expect the credit hours for the former to be less compared to the latter.

It follows that the credit hours for an engineering programme can be lower compared to that of an engineering technology programme. This is so because an engineering programme is more theory-

based compared to an engineering technology programme which takes a more hand-on approach, thus requiring more time. The higher credit hours on engineering technology programmes simply indicate that more student learning time is allocated in the programme so that students are able to understand and to apply the knowledge that is taught.

TABLE 5:

MASTER'S DEGREE (by Coursework)

Minimum Graduating Credits – 40

	Body of Knowledge	Credits*
COMPULSORY MODULES		
	HEPs Requirement (including Research Methodology)	2 – 9
DISCIPLINE CORE		
	Programme Core and Electives	21 – 26
PROJECT		
	Report	10 – 12

*Credits calculated are based on the Minimum Graduating Credits stated above.

TABLE 6:

MASTER'S DEGREE (by Mixed Mode)

Minimum Graduating Credits – 40

	Body of Knowledge	Credits*
COMPULSORY MODULES		
	HEPs Requirement (including Research Methodology)	4 – 8
DISCIPLINE CORE		
	Programme Core and Elective	12 – 16
PROJECT		
	Thesis/Dissertation	20 – 24

*Credits calculated are based on the Minimum Graduating Credits stated above.

TABLE 7:

MASTER'S DEGREE (by Research) & DOCTORAL DEGREE

Minimum Graduating Credits – no given credit value

Research Methodology or Relevant Prerequisite module as required.

For Master's Degree by Research and Doctoral Degree programmes, HEPs are required to submit and obtain approval for their processes from MQA.

ASSESSMENT OF STUDENTS

"Student assessment is a crucial aspect of quality assurance because it drives student learning and is one of the measures to show the achievement of learning outcomes. The achievement of learning outcomes stipulated for the programme is the basis in awarding qualifications. Hence, methods of student assessment have to be clear, consistent, effective, reliable and in line with current practices and must clearly support the achievement of learning outcomes" (COPPA, 2008, pp.15).

The methods of assessment depend on the specific requirements of each module. However, as a general guide, the following must be considered:

1) The usage of summative and formative assessments;

2) Knowledge and understanding (the cognitive domain) should be assessed through written, oral or other suitable means but practical skills should be assessed by practical evaluation such as laboratory, workshop, computer-based simulation and project work;

3) For modules requiring significant practical skills, a pass in practical evaluation is compulsory. (A pass implies that the examiner, using an appropriate assessment tool, is satisfied that the candidate has met the learning outcomes of the particular module.);

4) The following types of assessment indicated are merely examples. HEPs are encouraged to use a variety of methods and tools appropriate for measuring learning outcomes.

QUALIFICATIONS	OTHER APPROPRIATE FORMS OF ASSESSMENT
Certificate and Diploma	•Written Assessment •Oral Assessment •Practical Assessment •Laboratory Work •Project •Reports •Log Book

QUALIFICATIONS	OTHER APPROPRIATE FORMS OF ASSESSMENT
Bachelor's Degree	•Written Assessment •Oral Assessment •Practical Assessment •Laboratory Work •Reports •Mini Research / Final Year Project •Design Project •Oral Presentations
Master's Degree (by Coursework)	•Written Assessment •Project Dissertation •Presentations
Master's Degree (by Mixed Mode)	•Written Assessment •Project Paper •Presentations •Dissertation
Master's Degree (by Research)	•Presentations •Thesis (TWO examiners)* •Viva Voce
Doctoral Degree	•Thesis (TWO examiners)** •Viva Voce

Note: The proportion of continuous and final assessments should be determined by the institution to reflect the requirements of learning outcomes.

* at least ONE external examiner.

** at least ONE internationally recognised external examiner.

Generally, students shall be evaluated where appropriate through:

- Examinations/Tests
  - — Closed/Open book

- Viva Voce
- Mid and End of Semester

- Coursework
  - Assignment
  - Laboratory Report
  - Projects (Individual/Group)
  - Class Participation
  - Group Activities

STUDENT SELECTION

This section of the Programme Standards document concerns the recruitment of students into the individual programme of study. In general, admission policies of the programme need to comply with the prevailing policies of the Malaysian Ministry of Higher Education (MOHE).

"There are varying views on the best method of student selection. Whatever the method used, the Higher Education Provider (HEP) must be able to defend its consistency. The number of students to be admitted to the programme is determined by the capacity of the HEP and the number of qualified applicants. HEP admission and retention policies must not be compromised for the sole purpose of maintaining a desired enrolment. If a HEP operates geographically-separated campuses or if the programme is a collaborative one, the selection and assignment of all students must be consistent with national policies" (COPPA, 2008, pp.17).

The criteria for student admission into the Engineering and Engineering Technology programmes are provided in the following paragraphs. These criteria are developed with the national higher education policies pertaining to minimum student entry requirement in mind. HEPs must take into consideration any specific policies that may apply to their individual institution.

Note:

When students with specific disabilities (e.g. Color Blindness) are present, the institution has the responsibility of notifying the student of the limitations to employability.

CERTIFICATE in Engineering / Engineering Technology

Pass Sijil Pelajaran Malaysia (SPM) or its equivalent with at least ONE (1) credit in any subject AND a pass in Mathematics.

DIPLOMA in Engineering / Engineering Technology

Pass SPM or its equivalent with at least credits in THREE (3) subjects, including Mathematics and ONE (1) relevant science / technical / vocational subject AND a pass in English;

OR

Pass Sijil Tinggi Persekolahan Malaysia (STPM) or its equivalent with a pass in Mathematics, English and ONE (1) relevant science / technical / vocational subject at the SPM level;

OR

Recognised Certificate in Engineering / Engineering Technology or its equivalent;

OR

Recognised related Vocational and Technical / Skills Certificate or its equivalent with ONE (1) year of relevant work experience or a minimum of ONE (1) semester of a bridging programme.

For International students, Test of English as a Foreign Language (TOEFL) score of 500 OR **International English Language Testing System (IELTS)** score of 5.0 OR its equivalent.

If a student does not meet this requirement, HEPs must offer English proficiency courses to ensure that the student's proficiency is sufficient to meet the needs of the programme. This is normally conducted through an assessment process.

BACHELOR'S DEGREE in Engineering

Note: Accreditation of a four (4) year Bachelor's Degree in Engineering is in consultation with the Engineering Accreditation Council (EAC). Further guidelines can be obtained from the EAC manual at www.eac.org.my / www.bem.org.my.

BACHELOR'S DEGREE in Engineering Technology

Malaysian University English Test (MUET) Band 2 AND

Pass STPM or its equivalent with minimum Grade C (CGPA 2.0) in Mathematics and ONE (1) relevant Science subject AND

Pass SPM or its equivalent with at least a pass in English;

OR

Recognised Diploma in Engineering / Engineering Technology or its equivalent with minimum CGPA 2.0;

OR

Recognised related Vocational and Technical / Skills Diploma with minimum CGPA 2.0 AND a pass in English at SPM level.

For International students, TOEFL score of 500 OR **IELTS** score of 5.0 OR its equivalent.

If a student does not meet this requirement, HEPs must offer English proficiency courses to ensure that the student's proficiency is sufficient to meet the needs of the programme. This is normally conducted through an assessment process.

MASTER'S DEGREE (by Coursework or Mixed Mode)

Recognised Bachelor's Degree in Engineering / Engineering Technology or its equivalent with a minimum CGPA of 2.5 AND

For International students, TOEFL score of 500 OR **IELTS** score of 5.0 OR its equivalent.

If a student does not meet this requirement, HEPs must offer English proficiency courses to ensure that the student's proficiency is sufficient to meet the needs of the programme. This is normally conducted through an assessment process.

Note:

When candidates with Bachelor's of Science or Technology degrees or their equivalents (non-engineering or engineering technology) are admitted, prerequisite modules in Engineering and Engineering Technology must be offered to adequately prepare them for their advanced study.

Degree holders with CGPA above 2.0 but less than 2.5 may be admitted subject to a rigorous internal assessment process.

MASTER'S DEGREE (by Research)

Recognised Bachelor's Degree in Engineering / Engineering Technology or its equivalent with a minimum CGPA of 2.5 AND

For International students, TOEFL score of 500 OR **IELTS** score of 5.0 OR its equivalent.

If a student does not meet this requirement, HEPs must offer English proficiency courses to ensure

that the student's proficiency is sufficient to meet the needs of the programme. This is normally conducted through an assessment process.

Note:

Degree holders of Bachelor's of Science or Technology (non-engineering or engineering technology) with CGPA above 2.0 but less than 2.5 may be admitted, subject to a rigorous internal assessment process.

DOCTORAL DEGREE

Recognised Master's Degree or its equivalent AND

For International students, TOEFL score of 500 OR **IELTS** score of 5.0 OR its equivalent.

If a student does not meet this requirement, HEPs must offer English proficiency courses to ensure that the student's proficiency is sufficient to meet the needs of the programme. This is normally conducted through an assessment process.

Note:

Candidates registered for Master's Degrees may opt to convert their registration after a year to the doctoral Degree, subject to approval by the postgraduate committee of the HEPs.

ACADEMIC STAFF

"The quality of the academic staff is one of the most important components in assuring the quality of higher education and thus every effort must be made to establish proper and effective recruitment, service, development and appraisal policies that are conducive to staff productivity" (COPPA, 2008, pp.21).

This section contains benchmarked statements pertaining to the recruitment of academic staff.

CERTIFICATE in Engineering / Engineering Technology

- **Diploma** in the relevant area;

  OR

  Certificate in the relevant area with FIVE (5) years of industrial working experience, or possessing skills in the related area.

  (Should not exceed 50% of the total academic staff)

50% of the lecturers / instructors must have at least TWO (2) years of relevant industrial work experience or professional certification. If this is not met, the institution should have a staff industrial attachment scheme in place.

- Overall staff to student ratio – 1:20 or better.

- Full-time and part-time staff – At least 60% full-time.

  To start a programme in the conventional mode, a minimum of four full-time staff in the relevant field is required.

- Continuing Professional Development (CPD) for full-time staff according to their specialisation needs of at least 40 hours of relevant training per year.

DIPLOMA in Engineering

- **Bachelor's Degree** in the relevant area;

  OR

  Diploma in the relevant area with FIVE (5) years of industrial working experience, or possessing skills in the related area.

  (Should not exceed 30% of the total academic staff)

  30% of the lecturers / instructors must have at least TWO (2) years of relevant industrial work experience or professional certification. If this is not met, the institution should have a staff industrial attachment scheme in place.

- Overall staff to student ratio – 1:20 or better.

- Full-time and part-time staff – At least 60% full-time.

  To start a programme in the conventional mode, a minimum of six full-time staff in the relevant field is required.

- CPD for full-time staff according to their specialisation needs of at least 40 hours of relevant training per year.

DIPLOMA in Engineering Technology

- **Bachelor's Degree** in the relevant area;

  OR

  Diploma in the relevant area with FIVE (5) years of industrial working experience, or possessing skills in the related area.
  (Should not exceed 30% of the total academic staff)

  50% of the lecturers / instructors must have at least TWO (2) years of relevant industrial work experience or professional certification. If this is not met, the institution should have a staff industrial attachment scheme in place.

- Overall staff to student ratio – 1:20 or better.

- Full-time and part-time staff – At least 60% full-time.
  To start a programme in the conventional mode, a minimum of six full-time staff in the relevant field is required.

- CPD for full-time staff according to their specialisation needs of at least 40 hours of relevant training per year.

BACHELOR'S DEGREE in Engineering

Note: Accreditation of a four (4) year Bachelor's Degree in Engineering is in consultation with the Engineering Accreditation Council (EAC). Further guidelines can be obtained from the EAC manual at www.eac.org.my / www.bem.org.my.

BACHELOR'S DEGREE in Engineering Technology

- **Master's Degree** in the relevant area;

  OR

  Bachelor's Degree in the relevant area with FIVE (5) years of industrial working experience, or possessing skills in the related area.
  (Should not exceed 30% of the total academic staff)

30% of the lecturers / instructors must have at least TWO (2) years of relevant industrial work experience or professional certification. If this is not met, the institution should have a staff industrial attachment scheme in place.

- Overall staff to student ratio – 1:15 or better.

- Full-time and part-time staff – At least 60% full-time.
- To start a programme in the conventional mode, a minimum of eight full-time staff in the relevant field is required.

- CPD for full-time staff according to their specialisation needs of at least 40 hours of relevant training per year.

MASTER'S DEGREE (by Coursework and Mixed Mode)

- **Doctoral Degree** in the relevant area;
  (60% of the total academic staff should be involved in the delivery of the programme)

  OR

  Master's Degree in the relevant area with FIVE (5) years of relevant experience.

  The principal project supervisor must be a full-time lecturer of the HEP.

- Overall staff to student ratio – 1:15 or better.

- Full-time and part-time staff – At least 50% full-time.

- CPD for full-time staff according to their specialisation needs of at least 40 hours of relevant training per year.

MASTER'S DEGREE (by Research)

- **Doctoral Degree** in the relevant area;

  OR

  Master's Degree in the relevant area with FIVE (5) years of relevant research experience.
  The principal project supervisor must be a full-time lecturer of the HEP.

- CPD for full-time staff according to their specialisation needs of at least 40 hours of relevant training per year.

DOCTORAL DEGREE

- **Doctoral Degree** in the relevant area.

  Doctoral Degree holders without postgraduate research supervision experience should be supported by experienced peers.

  The principal project supervisor must be a full-time lecturer of the HEP.

- CPD for full-time staff according to their specialisation needs of at least 40 hours of relevant training per year.

EDUCATIONAL RESOURCES

"**Adequate educational resources are necessary to support the teaching-learning activities of the programme.** These resources include finance, expertise, physical infrastructure, information and communication technology, and research facilities. The physical facilities of a programme are largely guided by the needs of the specific field of study" (COPPA, 2008, pp.23).

HEPs must comply with the Occupational Safety and Health Act (OSHA) 1994, assign proper space and allocate resources adequately according to the number of students.

There should be sufficient numbers of qualified technical support staff to support the teaching and learning activities of the programme.

HEPs are required to provide sufficient resources to support teaching and learning in the various fields at various qualification levels as stated below.

CERTIFICATE and DIPLOMA in Engineering & CERTIFICATE in Engineering Technology

The following facilities are required:

- Lecture Rooms (with sufficient audio visual facilities);
- Computer Labs;
- Laboratories and Workshops;
- Tutorial Rooms;
- Activity Rooms;
- Library Facilities (including on-line resources);
    - Relevant Books and Journals
    - Manuals (e.g. Equipment and Material)
    - Industrial Standards (e.g. SIRIM, ASME, BS, JIS and DIN)
    - Industrial Publication (e.g. ABE and NIOSH)
    - Codes of Practice
- Internet Access; and
- Sufficient access to relevant software and hardware according to the needs of the programme.

BACHELOR'S DEGREE in Engineering

Note: Accreditation of a four (4) year Bachelor's Degree in Engineering is in consultation with the Engineering Accreditation Council (EAC). Further guidelines can be obtained from the EAC manual at www.eac.org.my / www.bem.org.my.

DIPLOMA and BACHELOR'S DEGREE in Engineering Technology

The following facilities are required:

- Lecture Rooms (with sufficient audio visual facilities);
- Labs / workshops / studios (where necessary and according to the needs of the programme);
  E.g.:
    - Computer Lab
    - General Lab
    - Specialised Lab
    - Design Studio
    - Machining Workshop
    - Testing Lab
    - Language Lab/Studio
    - Prototype Lab

    - Modelling Lab
- Tutorial / Discussion Rooms;
- Activity Rooms;
- Library Facilities (including on-line resources);
    - Relevant Books and Journals
    - Manuals
    - Industrial Standards (e.g. SIRIM, ASME, BS, JIS and DIN)
    - Industrial Publication (e.g. ABE and NIOSH)
    - Codes of Practice
- Internet Access;
- Sufficient access to relevant software and hardware according to the needs of the programme;
- General / Specialised components / equipment similar to industrial use (1 set of equipment should be allocated to a group of not more than 5 students for a practical session); and
- Experimental laboratory for practical work must be specific to the technical areas under the programme.

Depending on the programme Learning Outcomes, students maybe required to have INDIVIDUAL access to practise or clock actual man hours on particular equipment.

HEPs must provide access to these lab facilities on their premises or through external facilities. Evidence of these is required.

MASTER'S and DOCTORAL DEGREE

The following facilities are required:

- Lecture Rooms (with sufficient audio visual facilities);
- Labs / workshops / studios (where necessary and according to the needs of the programme);

  E.g.:
    - Computer Lab
    - General Lab
    - Specialised Lab
    - Design Studio
    - Machining Workshop
    - Testing Lab
    - Language Lab/Studio
    - Prototype Lab
    - Modelling Lab

- Tutorial / Discussion Rooms;
- Activity Rooms;
- Library Facilities (including on-line resources);
    - Relevant Books and Journals
    - Manuals
    - Industrial Standards (e.g. SIRIM, ASME, BS, JIS and DIN)
    - Industrial Publication (e.g. ABE and NIOSH)
    - Codes of Practice
- Internet Access;
- Sufficient access to relevant software and hardware according to the needs of the programme;
- Experimental laboratory for practical work must be specific to the technical areas under the programme;
- Specialised laboratory for postgraduate research related to the research programme; and
- For Master's and Doctoral Degrees by Research, a personal workstation should be allocated.

PROGRAMME MONITORING AND REVIEW

"Quality enhancement calls for programmes to be regularly monitored, reviewed and evaluated. This includes the monitoring, reviewing and evaluating of institutional structures and processes (administrative structure, leadership and governance, and, planning and review mechanisms), curriculum components (syllabi, teaching methodologies, and learning outcomes) as well as student progress, employability and performance.

Feedback from multiple sources such as the students, alumni, academic staff, employers, professional bodies and parents to assist in enhancing the quality of the programme. Feedback can also be obtained from an analysis of student performance and from longitudinal studies.

Measures of student performance would include the average study duration, assessment scores, passing rate at examinations, success and dropout rates, students' and alumni's reports about their learning experience, as well as time spent by students in areas of special interest. Evaluation of student performance in examinations can reveal very useful information. If student selection has been correctly done, a high failure rate in a programme, could indicate something amiss in the curriculum content, teaching-learning activities or assessment system. The programme committees need to monitor the performance rate in each course and investigate if the rate is too high or too low.

Student feedback, for example, through questionnaires and representation in programme committees, is useful for identifying specific problems and for continual improvement of the programme.

One method to evaluate programme effectiveness is a longitudinal study of the graduates. The department should have mechanisms for monitoring the performance of its graduates and for obtaining the perceptions of society and employers on the strengths and weaknesses of the graduates and to respond appropriately" (COPPA, 2008, pp.27).

LEADERSHIP, GOVERNANCE AND ADMINISTRATION

"There are many ways of administering an educational institution and the methods of management differ between HEPs. Nevertheless, governance that reflects the leadership of an academic organisation must emphasise excellence and scholarship. At the departmental level, it is crucial that the leadership provides clear guidelines and direction, builds relationships amongst the different constituents based on collegiality and transparency, manages finances and other resources with accountability, forges partnership with significant stakeholders in educational delivery, research and consultancy and dedicates itself to academic and scholarly endeavours. Whilst formalised arrangements can protect these relationships, they are best developed by a culture of reciprocity, mutuality and open communication" (COPPA, 2008, pp.28).

This document will not raise issues pertaining to governance and administration as these are at the institutional rather than at the programme level. The issue on academic programme leadership is largely focused on the need for an expert within the field of study, who is able to carry out the necessary curriculum monitoring and review in the light of new developments in the field.

HEPs should distinguish further between academic leadership and administrative leadership which may be in the hands of persons suitably qualified but not from within the field concerned.

Specific to the level offered at the HEP, the programme academic leadership must fulfill the following qualification and experience:

CERTIFICATE and DIPLOMA

Bachelor's Degree in related field with THREE (3) years of experience.

BACHELOR'S DEGREE

Master's Degree in related field with THREE (3) years of experience, preferably with a Professional Engineer's (PEng) qualification.

POSTGRADUATE DEGREES

Doctoral Degree in related field with FIVE (5) years of experience.

CONTINUAL QUALITY IMPROVEMENT

"Increasingly, society demands greater accountability from HEPs. Needs are constantly changing because of the advancements in science and technology, and the explosive growth in global knowledge, which are rapidly and widely disseminated. In facing these challenges, HEPs have little choice but to become dynamic learning organisations that need to continually and systematically review and monitor the various issues so as to meet the demands of the constantly changing environment" (COPPA, 2008, pp.30-31).

The HEPs are expected to provide evidence of their ability to keep pace with changes in the field and with the requirements of stakeholders. These may be demonstrated by, but not limited to:

1. an annual module review;
2. a programme curriculum review, conducted at least once every 2-4 years;
3. the appointment of an external examiner / industrial adviser for quality assessment processes;
4. a periodic calibration of equipment or when necessary;

5. engagement with the Engineering and Engineering Technology industry;
6. a continuous review of industrial attachment practices and records;
7. dialogue sessions with stakeholders;
8. an active participation by the academic staff at relevant conferences, seminars, workshops and short courses;
9. presentations by invited speakers, either local or international; and
10. organisation of conferences, seminars and workshops.

REFERENCES

1. Engineering Accreditation Council (2007). Engineering Programme Accreditation Manual. Malaysia.

2. Engineering Council of the UK (2001). The Sydney Accord Agreement – Recognition of Equivalence of Accredited Engineering Technology Education Programs. South Africa.

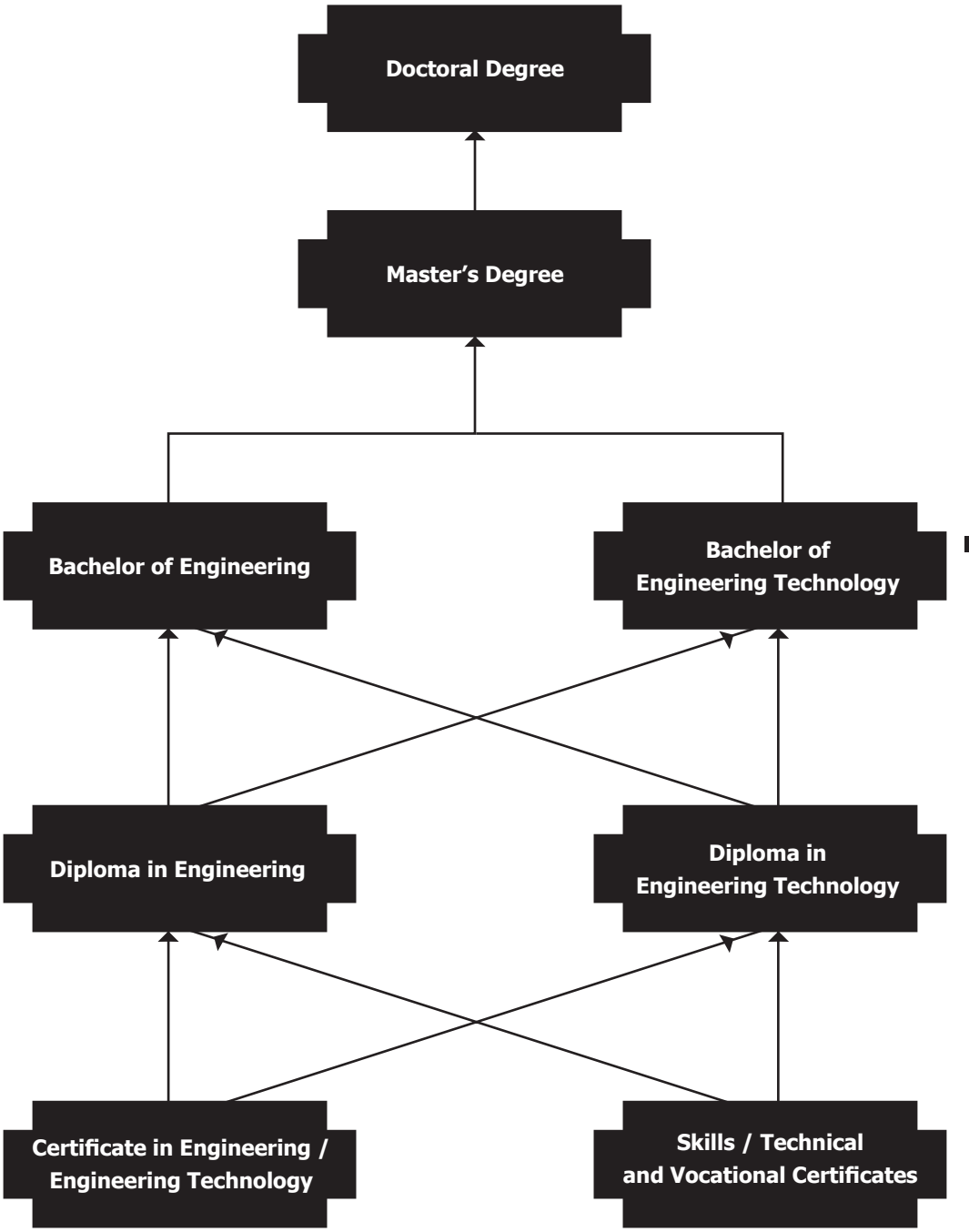
3. Malaysian Qualifications Agency (2007). Malaysian Qualifications Framework - MQF. Malaysia.

4. Malaysian Qualifications Agency (2008). Code of Practice for Programme Accreditation – COPPA. Malaysia.

5. The Institution of Engineers of Ireland (2002). The Dublin Accord Agreement – Recognition of Equivalence of Educational Base for Engineering Technicians. Dublin, Ireland.

ENGINEERING AND ENGINEERING TECHNOLOGY

ACADEMIC PATHWAY



Appendix 2

SAMPLE OF EXISTING NOMENCLATURES

CERTIFICATE

ENGINEERING / ENGINEERING TECHNOLOGY

Certificate in Agricultural Engineering
Certificate in Automotive
Certificate in Building Services Engineering
Certificate in Chemical and Process Engineering
Certificate in Civil Engineering
Certificate in Civil Engineering (Construction)
Certificate in Civil Engineering (Highway)
Certificate in Civil Engineering (Works and Hydrology)
Certificate in Electrical and Electronic Engineering
Certificate in Electrical Engineering (Power)
Certificate in Electrical and Electronics Engineering
Certificate in Electrical Engineering
Certificate in Electrical Technology
Certificate in Electrical Wiring Technology
Certificate in Electronic Engineering (Communication)
Certificate in Electronic Engineering (Computer)
Certificate in Computer Technology
Certificate in Industrial Electronics
Certificate in Manufacturing Engineering (Machining)
Certificate in Manufacturing Engineering (Product Design)
Certificate in Mechanical Engineering (Agricultural)
Certificate in Mechanical Engineering (Automotive)
Certificate in Mechanical Engineering (Materials)
Certificate in Mechanical Engineering (Packaging)
Certificate in Mechanical Engineering (Plastic)
Certificate in Mechanical Engineering (Textile)
Certificate in Refrigeration and Air Conditioning

DIPLOMA

ENGINEERING

Diploma in Agricultural Engineering
Diploma in Automotive Engineering
Diploma in Building Services Engineering
Diploma in Chemical Engineering
Diploma in Chemical Engineering (Process Plant)
Diploma in Civil Engineering
Diploma in Civil Engineering (Building Services and Maintenance)
Diploma in Civil Engineering (Construction)
Diploma in Civil Engineering (Engineering Survey)
Diploma in Civil Engineering with Education
Diploma in Computer and Electronics Engineering
Diploma in Electrical and Electronic Engineering
Diploma in Electrical and Computer Engineering
Diploma in Electrical Engineering (Communication)
Diploma in Electrical Engineering (Control and Power Electronics)
Diploma in Electrical Engineering (Electronic)
Diploma in Electrical Engineering (Industrial Electronic)
Diploma In Electrical Engineering (Instrumentation)
Diploma in Electrical Engineering (Mechatronics)
Diploma in Electrical Engineering (Power)
Diploma in Electro-Mechanical Engineering
Diploma in Electronic Engineering
Diploma in Electronic Engineering (Communication)
Diploma in Electronic Engineering (Computer)
Diploma in Electronic Engineering (Control)
Diploma in Electronic Engineering (Medical)
Diploma in Environmental Engineering
Diploma in Geomatic Engineering
Diploma in Industrial Engineering
Diploma in Information Engineering
Diploma in Manufacturing and Industrial Engineering
Diploma in Manufacturing Engineering
Diploma in Manufacturing Engineering (Tool and Die Design)

Diploma in Marine Engineering
Diploma in Marine Engineering (Shipping)
Diploma in Mechanical Engineering
Diploma in Mechanical Engineering (Aeronautic)
Diploma in Mechanical Engineering (Agricultural)
Diploma in Mechanical Engineering (Automotive)
Diploma in Mechanical Engineering (Manufacturing)
Diploma in Mechanical Engineering (Materials)
Diploma in Mechanical Engineering (Packaging)
Diploma in Mechanical Engineering (Plant)
Diploma in Mechanical Engineering (Plastic)
Diploma in Mechanical Engineering (Refrigeration and Air Conditioning)
Diploma in Mechanical Engineering (Textile)
Diploma in Mechatronic Engineering
Diploma in Mechatronics
Diploma In Mechatronics and Robotics Engineering
Diploma in Microelectronic Engineering
Diploma in Telecommunication and Computer Engineering
Diploma in Telecommunication Engineering

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Diploma in Aircraft Maintenance Technology
Diploma in Aircraft Maintenance Technology (Avionics)
Diploma in Aircraft Maintenance Technology (Composite)
Diploma in Aircraft Maintenance Technology (Manufacturing)
Diploma in Audio Technology
Diploma in Automotive Technology
Diploma in Chemical Engineering Technology
Diploma in Chemical Engineering Technology (Bioprocess)
Diploma in Chemical Engineering Technology (Environmental)
Diploma in Chemical Engineering Technology (Food)
Diploma in Chemical Engineering Technology (Food)
Diploma in Chemical Engineering Technology (Process)
Diploma in Electrical Technology
Diploma in Electrical Technology (Power)
Diploma in Electronic Technology (Industry)

Diploma in Electronic Technology
Diploma in Electronics and Communication Engineering
Diploma in Engineering Technology (Electrical and Electronics)
Diploma in Engineering Technology (Machine Manufacturing and Maintenance)
Diploma in Engineering Technology (Medical Electronics)
Diploma in Engineering Technology (Telecommunication Engineering)
Diploma in Engineering Technology (Air Conditioning and Refrigeration)
Diploma in Engineering Technology (Automated Regulation and Control)
Diploma in Engineering Technology (Automotive)
Diploma in Engineering Technology (Computer and Networking)
Diploma in Engineering Technology (Computing)
Diploma in Engineering Technology in Mechanical Design and Development
Diploma in Engineering Technology in Metal Fabrication
Diploma in Engineering Technology in Mould Manufacturing
Diploma in Engineering Technology in Production Engineering
Diploma in Engineering Technology in Welding
Diploma in Industrial Automation (Computer Integrated Design)
Diploma in Industrial Automation (Information Technology)
Diploma in Industrial Electronic Technology
Diploma in Industrial Electronics (Electronics and Information Technology)
Diploma in Industrial Electronics (Mechatronics)
Diploma in Industrial Electronics (Process Instrumentation and Control)
Diploma in Maritime Engineering Technology
Diploma in Polymer Engineering Technology
Diploma in Production Technology (Mould Technology)
Diploma in Production Technology (Tool and Die Technology)

BACHELOR'S DEGREE

ENGINEERING – refer to EAC / BEM

ENGINEERING TECHNOLOGY

Bachelor of Engineering Technology (Networking Systems)
Bachelor of Engineering Technology (Electrical)
Bachelor of Engineering Technology (Electronic)
Bachelor of Engineering Technology (Tool and Die)

Bachelor of Engineering Technology (Product Design)
Bachelor of Engineering Technology (Air Conditioning and Industrial Refrigeration)
Bachelor of Engineering Technology (Industrial Automation and Robotics)
Bachelor of Engineering Technology (Mechatronics)
Bachelor of Engineering Technology (Biosystem)
Bachelor of Aeronautical Engineering Technology (Professional Piloting)
Bachelor of Aeronautical Engineering Technology (Aircraft Maintenance)

MASTER'S DEGREE

ENGINEERING

Master of Civil Engineering
Master of Electrical Engineering
Master of Engineering (Telecommunication)
Master of Mechanical Engineering
Master of Science (Petroleum Engineering)
Master of Science (Systems Engineering and Management)
MSc in Chemical Engineering
MSc in Mechanical Engineering

DOCTORAL DEGREE

ENGINEERING

Doctor of Philosophy in Engineering
Doctor of Philosophy (Civil Engineering)
Doctor of Philosophy (Chemical Engineering)
Doctor of Philosophy (Mechanical Engineering)
Doctor of Philosophy (Electrical and Electronics Engineering)

MODE OF DELIVERY

ENGINEERING

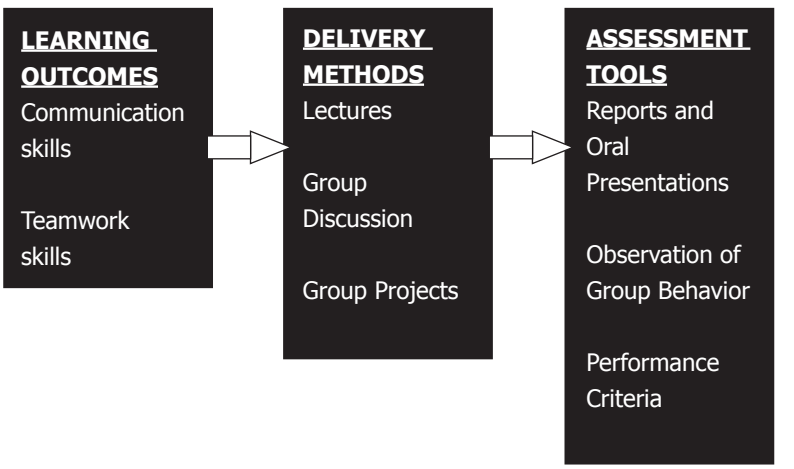
Whilst it is not possible to prescribe the most suitable delivery method for all programmes, this Programme Standards document emphasizes the need for HEPs to ensure a variety of delivery methods that will facilitate the development of the learning outcomes associated with individual courses / modules. The delivery methods adopted must clearly demonstrate incremental achievement of learning outcomes of courses / modules offered in different semesters and at different qualification levels.

The delivery methods can include:

A. lectures with active learning
B. tutorials and group discussions
C. laboratory work with collaborative learning
D. field work or relevant industrial training
E. site visits
F. group projects with co-operative learning
G. individual projects
H. directed self-learning tasks
I. problem-based learning (PBL)

HEPs must also ensure that the various delivery modes adopted are accompanied by appropriate assessment tools so that the achievement of the various learning outcomes associated with the course / module is attained. Appropriate performance criteria (assessment rubrics) must be developed to assess the learning outcomes associated with a particular assessment tool.

Example:



A NOTE ON CREDIT HOURS

The credit-hour system used in Malaysian Universities reflects the students' contact hours during a particular semester. The number of credit hours allocated is based on the delivery mode used to deliver the contents of a course / module. For example, one hour of lecture per week over a fifteen-week semester constitutes one credit hour, while three hours of laboratory session or studio work per week also constitutes one credit hour. For every one hour of lecture, students are expected to spend two to three hours on their own to prepare and to revise the lessons associated with the lecture. Longer hours are allotted for laboratory sessions even though a lower credit hour is given, as relatively less time is needed to prepare for a laboratory session compared to lectures. While credit hours calculated based on contact time have been accepted in Malaysia, concerns have been raised on the actual amount of time that is spent by students outside the classroom. There have been instances where students spend too little time on the course outside the classroom. There are also instances where too much work is assigned. In addition, no form of monitoring or enforcement exists to ensure that students are engaged in learning activities related to the formal contact time.

A study was conducted by Professor Dato' Ir. Dr. Zainai Mohamed in 2005 to ascertain the ideal or appropriate amount of time that students should spend on a course for a given credit hour. The study concluded that for every one credit hour specified, students need to spend 40 hours of learning. This was determined by considering the total amount of time available in a week, the time needed for personal matters, the time for rest and recreational activities, and the time for studying. For a course of three credit hours, students will have to spend 120 hours, which involves both face-to-face meetings (lectures / laboratory work / tutorials, etc.) and non-face-to-face activities. In view of this, the conventional understanding of credit hours must be reviewed. The credit hour is no longer based on the number of formal contact hours students have to fulfill in a course; instead, it is based on all types of learning activities, be it face-to-face or otherwise.

The concept of Student Learning Time (SLT) is believed to be more effective in ensuring that the learning process is not under-or-over-loading students. It requires instructors to plan their lessons beyond the content. Instructors also need to consider their delivery methods and the learning activities that students need to conduct on their own in the non-face-to-face mode. For a given course with the same content, different credit hours may be assigned to the course depending on the delivery mode and learning activities designed by the instructors for the students.