Key Points of the Engineering Accreditation Council Engineering Programme Accreditation Manual 2017


Ir. Liew Chia Pao


Ir. Dr Siti Hawa Hamzah


Ir. Dr Vinesh Thiruchelvam

The Board of Engineers Malaysia (BEM) approved the Engineering Accreditation Council Engineering Programme Accreditation Manual 2017 (EAC Manual 2017) on 21 August, 2017. This will be the reference for all engineering programmes, effective 1 September, 2017. All programmes are expected to comply with the new requirements by 31 August, 2018.

This paper focuses on the key changes of the new EAC Manual 2017 in comparison to the 2012 version (EAC Manual 2012) and highlights the 8 qualifying requirements which are meant to screen out programmes which do not meet the core requirements of the assessment criteria. Other major changes or inclusions, such as accreditation cycle, self-assessment report, revisions to accredited programmes, benchmarking, credit exemption and credit transfer, safety, health and environment, continuing and interim programmes accreditation and underpinning courses are also discussed.

This paper is expected to help Institutions of Higher Learning (IHLs) with the implementation of the changes in their programmes.

1. QUALIFYING REQUIREMENTS

The number of qualifying requirements in the EAC Manual 2017 remains at 8, even with the introduction of Integrated Design Project (IDP) as the previous qualifying requirements of Programme Educational Objectives and Programme Outcomes have been categorised as Outcome-based Education (OBE) in the EAC Manual 2017.

Table 1: Qualifying Requirements of the EAC Manual 2017 in comparison to EAC Manual 2012

1. Outcome-based Education Implementation
• Programme Educational Objectives and Programme Outcomes
2. Credit Requirement -CHANGES
• Minimum of 135 SLT credits of which 90 must be engineering courses offered over a period of 4 yeras (changes)
3. Integrated Design Project - NEW
• New requirement
4. Final Year Project
• Minimum 6 credits
5. Industrial Training
• Minimum of 8 weeks
6. Academic Staff - CHANGES
• Minimum of 8 full-time with at least 3 Professional Engineers registered with the BEM or equivalent
7. Staff to Student Ratio
• 1:20 or better
8. External Examiner's Report - CHANGES
• Minimum 1 report every 2 year

Table 1 shows the qualifying requirements of the EAC Manual 2017 in comparison to EAC Manual 2012. The key changes of the qualifying requirements will be discussed in this section.

1.1 Outcome-based Education Implementation

Two qualifying requirements in the earlier EAC Manual 2012, i.e. Programme Educational Objectives (PEO) and Programme Outcomes (PO) have been combined in a single criterion, named Outcome-based Education (OBE) implementation. The EAC Manual 2017 requires that PEOs be considered in the design and review of the curriculum in a top-down approach. The OBE model adopted by the IHLs is expected to drive Continual Quality Improvement (CQI) at both course and programme levels and/or will improve student performance.

The EAC Manual 2017 has also adopted the International Engineering Alliance 2013 Graduate Attributes via the mapping of the Programme Outcomes to the Knowledge Profile, i.e. profiles of graduates (known as WK1

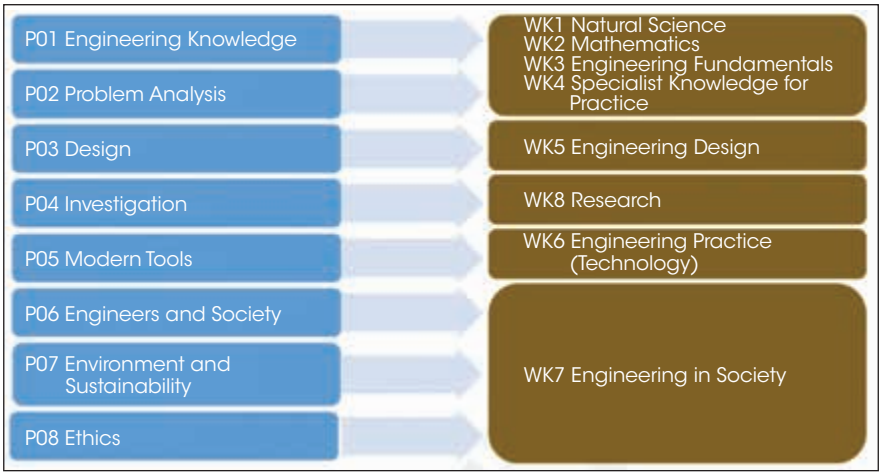

Figure 1: Mapping of EAC Programme Outcomes to Washington Accord Knowledge Profile

to WK8) and complex problem solving is emphasised in the outcomes, Engineers and Society, and Environment and Sustainability. The Programme Outcomes on Engineering Knowledge and Problem Analysis are required to address WK1 to WK4 (Theory-based Natural Sciences, Conceptually-based Mathematics, Theory-based Engineering Fundamentals and Forefront Specialist Knowledge for Practice), Design/Development of Solutions was mapped WK5 (Engineering Design), Investigation is mapped to WK8 (Research Literature), Modern Tools is mapped to WK6 (Engineering Practice (Technology), and Engineer and Society, Ethics, and Environment & Sustainability is mapped to WK7 (Comprehension Engineering in Society) as shown in Figure 1.

The range of complex problem solving and complex engineering activities are shown in Figure 2. It is worth mentioning that complex engineering problems have the characteristic of Depth of Knowledge (known as WP1) and some or all of other characteristics (WP2 to WP7). The attribute, WP1 Depth of Knowledge, means complex problem solving that requires in-depth engineering knowledge at the level of one or more of WK3, WK4, WK5, WK6 or WK8. In the capacity of complex engineering activities, some or all of the five characteristics are to be evident.

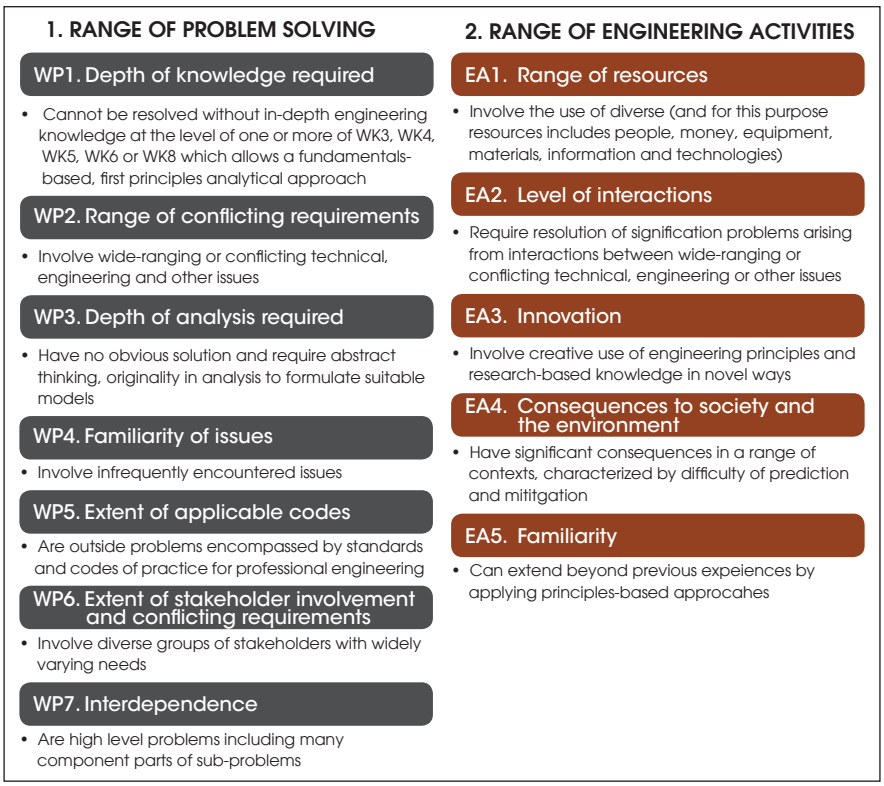

Figure 2: Range of Problem Solving and Range of Engineering Activities

1.2 Outcome-based Education Implementation

The EAC Manual 2017 introduces a credit system based on Student Learning Time (SLT), replacing the credit hour system as per EAC Manual 2012. The SLT credit is based on the Student Learning Time (SLT) as defined in the Malaysian Qualification Framework (MQF). The SLT defines that for every one credit hour specified, students need to spend 40 hours of learning. Although the EAC Manual 2012 allocated independent study time for lecture, tutorial, laboratory etc., it did not take into account the time required to prepare for and take assessments. Hence the number of credits has been increased from 120 to 135 to cater to the additional time required for assessments. The number of credits for engineering courses is increased from 80 to 90 in accordance with the increase number of credits of the engineering programmes.

IHLs may consider reducing face-to-face to include non-face-to-face activities and assessment preparation time (and sitting) without compromising on the depth of knowledge or may expand existing credits to include non-face-to-face activities and assessment preparation time (and sitting) without exceeding the recommended student workload of 18-20 credits per semester (assuming a 14-week semester) or mixture of both.

For the purpose of calculation of SLT, Table 2 shows an example for a three-credit course, Engineers & Society, which may consist of two hours of lectures per week for a 14-week semester with a final examination (40% weightage) and three assignments (60% weightage). The average student may spend four hours of preparation for a two-hour lecture, 30 hours of preparation for three assignments of 2000 words and nine hours of preparation for a three-hour final examination. So the total guided learning time is two hours X 14 weeks, the total self-learning time is four hours X 14 weeks, and the total assessment time is 30 hours for preparing assignments and 12 hours for preparing and sitting for the final examination, making the total SLT of 126 hours. Dividing the SLT of 126 hours with 40 notional hours equals to 3.2 credits.

Table 2: Example of SLT Calculation for a three-credit Course (Engineers and Society)

14-WEEK SEMESTER	SLT CREDIT SYSTEM	REMARKS
Lecture	2 hours X 14 weeks	-
Self-learning time	4 hours X 14 weeks	-
Continuous assessment preparation time	30 hours	3 assignments of 2000 words
Examination preparation and sitting time	12 hours	3 hours final examination with 9 hours of preparation
Total SLT	126 hours	-
CREDIT	**126/40 = 3.2**	**A 3-credit course**

1.3 Integrated Design Project

The EAC Manual 2017 includes the Integrated Design Project (IDP) as the new qualifying requirement to emphasise its importance. The IDP shall involve complex engineering problems and design systems, components or processes integrating (culminating) core areas and meeting specified needs for public health and safety, cultural, societal, project management, economy and environmental considerations where appropriate. The IDP acts as the capping stone of fundamental conceptual design knowledge and to emulate industrial practice. Students should be working and managing projects as a group. Although the credit requirement for IDP is not spelt out, the programme is expected to seize the opportunity to deliver and assess many relevant programme outcomes through the IDP.

1.4 Final Year Project

The Final Year Project (FYP) remains one of the best means of introducing an investigative research-oriented approach in engineering studies. It was introduced to seek individual analysis and judgement, and should be assessed independently. Students are expected to develop techniques in literature review and to process technical information as well as to utilise appropriate modern tools in some aspects of work. This requirement remains unchanged.

1.5 Industrial Training

Industrial training remains compulsory for a minimum of eight (8) continuous weeks and must be conducted before the final semester in the fourth year of study. It is worthy to note that the aim is to expose students to professional engineering practices, so they should be placed in relevant engineering organisations. There should be a structured industrial training process in place and supervision done by qualified personnel. This requirement remains unchanged.

1.6 Academic Staff

A viable engineering programme is expected to have a minimum of 8 full-time academic staff whose first degree must be in an engineering discipline relevant to the programme. The EAC Manual 2017 emphasises the need for this in order to have the necessary competencies to cover the required areas of an engineering programme. In addition, every programme shall have at least 3 full-time Professional Engineers who are registered with the BEM or its equivalent, and who are actively teaching the programme. Equivalency includes professional qualifications from the International Professional Engineers Agreement (IPEA), Asia Pacific Economic Co-operation (APEC) and Washington Accord's signatories. All academic staff who are eligible must also register with the BEM, in line with the requirement of the Registration of Engineers Act 1967 (Revised 2015).

1.7 Staff to Student Ratio

The requirement of Staff to Student Ratio remains unchanged at 1:20 or better, ideally, 1:15.

1.8 External Examiner's Report

An external examiner's report is now required for every two years; the earlier requirement of two reports per cycle was subjected to misinterpretation. Although the earlier EAC Manual 2012 preferred that the assessment be carried out during the initial period of the accreditation cycle and another before the accreditation visit, some IHLs conducted two external examiner assessments at the end of the accreditation cycle where the outcomes were not beneficial to programme improvements. The Appendix E of the EAC Manual 2017 was revised to include the assessment, OBE implementation and achievement of the programme outcomes of the students and moderation process of assessments.

2. OTHER MAJOR CHANGES/ INCLUSIONS

a) ***Accreditation Cycle:*** The accreditation cycle was increased from 5 to 6 years to be consistent with the practice in the Engineering Technology and Engineering Technician accreditation manuals and the International Engineering Alliance (IEA). The number of accreditation years awarded to the programme will be based on the number of concerns arising and the decision by EAC.

b) ***Self-Assessment Report:*** A Self-Assessment Report (SAR) is an account of the IHL plan, implementation, assessment and evaluation of the programme conducted. It reflects the processes with results obtained which are used in continual quality improvements at all levels of the programme's activities. The SAR should address the key questions in Section 7 of the manual. In the EAC Manual 2017, the IHL is required to resubmit its application for accreditation visit if it is found to be of unacceptable quality. There were previous cases where the SAR was merely a compilation of information and not self-assessment or did not adhere to the required format as per Section 7 of the manual.

c) ***Revisions to an Accredited Programme:*** The EAC Manual 2017 requires IHLs to update the EAC and the Malaysian Qualifications Agency (MQA) on major changes that may impact an accredited programme. These include changes such as 30% or more of academic curriculum, change of location, pathways, programme name or programme duration, and others.

d) ***Benchmarking:*** The new manual also requires an IHL to demonstrate that appropriate benchmarking has been carried out with similar accredited/recognised programme(s) offered at other IHLs. The benchmarking shall include identifying any gap in the academic curriculum for course or programme improvement.

e) ***Credit Exemption and Credit Transfer:*** The credit and course exemption from lower to higher level, i.e. accredited or recognised Diploma to Bachelor degree, a maximum exemption of 30% of the total programme credits remains unchanged. However, there is a new clause that allows for credit transfer between accredited or recognised programmes of same level, i.e. from Bachelor to Bachelor degree with a maximum transfer of 50% of the total programme credits.

f) ***Health, Safety & Environment (HSE):*** In this area, the IHL is required to demonstrate that there is a system for the management and implementation of HSE. As HSE culture is of utmost importance, it's a major factor that may affect the accreditation decision. The IHL shall demonstrate activities to inculcate the HSE culture among staff and students and to comply with any or all applicable rules or regulations pertaining to safety, health and environment.

g) ***Continuing and Interim Programmes Accreditation:*** For programmes that have been accorded accreditation with

interim conditions or programmes applying for extension of accreditation in the same cycle, the IHL shall submit an addendum in addition to the report related to concerns listed under the accreditation conditions. This addendum shall include updates on the fulfilment of the 8 Qualifying Requirements and a report on how the programme is addressing (closing the gap) newly introduced/revised accreditation requirements by the EAC, among others. The concerns listed under the accreditation conditions must be closed for obtaining the remaining accreditation years to be recommended by the evaluation panel to the EAC.

h) Appendix B: Engineering Contents for Selected Engineering Disciplines and Innovative Programmes: For the Chemical Engineering discipline, the recommended courses, Plant and Equipment Design, have been extended to include Economics while Viability – Legal Framework, Economics, Operability and Reliability have been removed.

For the Electronic Engineering discipline, the recommended course, Multimedia Technology and Applications, has been removed and Digital Signal Processing & Application included.

CONCLUSION

The EAC Manual 2017 was the result of meetings carried out by the various stakeholders in late 2016 and early 2017 which led to an improved version of the EAC Manual 2012. The new manual paves the way for industry involvement with the requirement of Professional Engineers as a qualifier for programme accreditation and introduces SLT for a student-centred approach in the delivery of the curriculum. It also emphasises the importance of IDP for students to apply design knowledge with the spirit of emulating real-work industrial experience, and complex problem-solving in the engineering programmes. These key changes are expected to further improve the attributes and capabilities of graduates, making them more relevant to the industry and fit to undertake a programme of training and experiential learning leading to professional competence and registration. ■

REFERENCES

[1] EAC (2017). *Engineering Programme Accreditation Manual*. Engineering Accreditation Council Malaysia. Accessed at http://www.eac.org.my/web/document/ on 18 Sep 2017.

[2] IEA (2013). *Graduate Attributes and Professional Competencies*. International Engineering Alliance. Accessed at http://www.ieagreements.org/assets/Uploads/Documents/Policy/ on 18 Sep 2017.

Authors' Biodata

Ir. Liew Chia Pao *is a Principal Lecturer in the Faculty of Engineering, Tunku Abdul Rahman University College (TAR UC) and currently, an Associate Director (Electronic Engineering) of the Accreditation Department, BEM. He had over 11 years of industry experience, as an R&D Engineer and Project Manager in powerline communication with OCM-Web, a recipient of Industry R&D Grant Scheme, MOSTI, and as an Analyst in industrial and electronics sector with Frost & Sullivan. His research areas are complex problem solving in engineering and programme outcomes assessment.*

Ir. Dr Siti Hawa Hamzah *is currently, an Associate Director (Civil Engineering) Accreditation Department BEM, the IEA mentor to Bangladesh Board of Accreditation for Engineering and Technical Education into Washington Accord Full Signatory Membership, OBE Trainer (CEE UTM - MOHE Afghanistan World Bank Project), BEM Lead Accreditation Evaluator, P.Eng Principle Interviewer, and BEM T&E Committee Member. She had over 33 years teaching and academic experience with 20 years experience managing engineering programmes; accreditation evaluator's experience in more than 100 programmes; completed 21 research projects; authored 11 books in structural engineering, published more than 165 technical papers, and accreditation videos on You Tube.*

Ir. Prof. Dr Vinesh Thiruchelvam *is the advisor in Engineering Education Technical Division (E2TD) and currently, the Dean of Computing, Engineering & Technology at Asia Pacific University of Technology & Innovation (APU). He has a wide industrial design exposure for the property sector, ports, oil & gas and power plant industries. His scholarly research areas are in Sustainable Development, Reliability Engineering using Smart Devices with IoT and Data Analytics with Business Intelligence.*