QUALIFICATION STANDARD FOR BACHELOR OF ENGINEERING (Hons) AND BACHELOR OF SCIENCE (Hons) in ENGINEERING PROGRAMMES

Document Reference: EAB-A02-P

Short Title: Qualification Standard for BEng (Hons) / BSc (Eng.)(Hons) Programmes

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Purpose of this Document

This document lays down the standard of the engineering degree programme leading to the award of a BEng (Hons) or BSc (Eng.)(Hons) eligible for accreditation by the Engineering Accreditation Board against the accreditation criteria spelt out in document EAB-A03-P: ***Criteria for Accreditation of Engineering Degree Programmes Meeting Stage-1 of CRPE Registration Requirements.***

Note: Expressions used in this document shall have the meaning given in the Appendix A.1 and A.2 of document **EAB-A01-P:** ***Background to Accreditation of Engineering Degree Programmes***

Appendix B of ***this document*** **contains a selection, and in a few cases, an explanation of some terms which are used in this document.**

CONTENTS

1. EAB Engineering Programme Accreditation System Documents

A list of documents constituting the EAB Engineering Programme Accreditation System meeting the educational requirements for registration as a Registered Professional Engineer with the Council of Registered Professional Engineers (Mauritius) is to be found hereafter in **Chart EAB-A02-P**, as well as in the document **EAB-A10-P:** ***Accreditation Policy on Engineering Degree Programmes***.

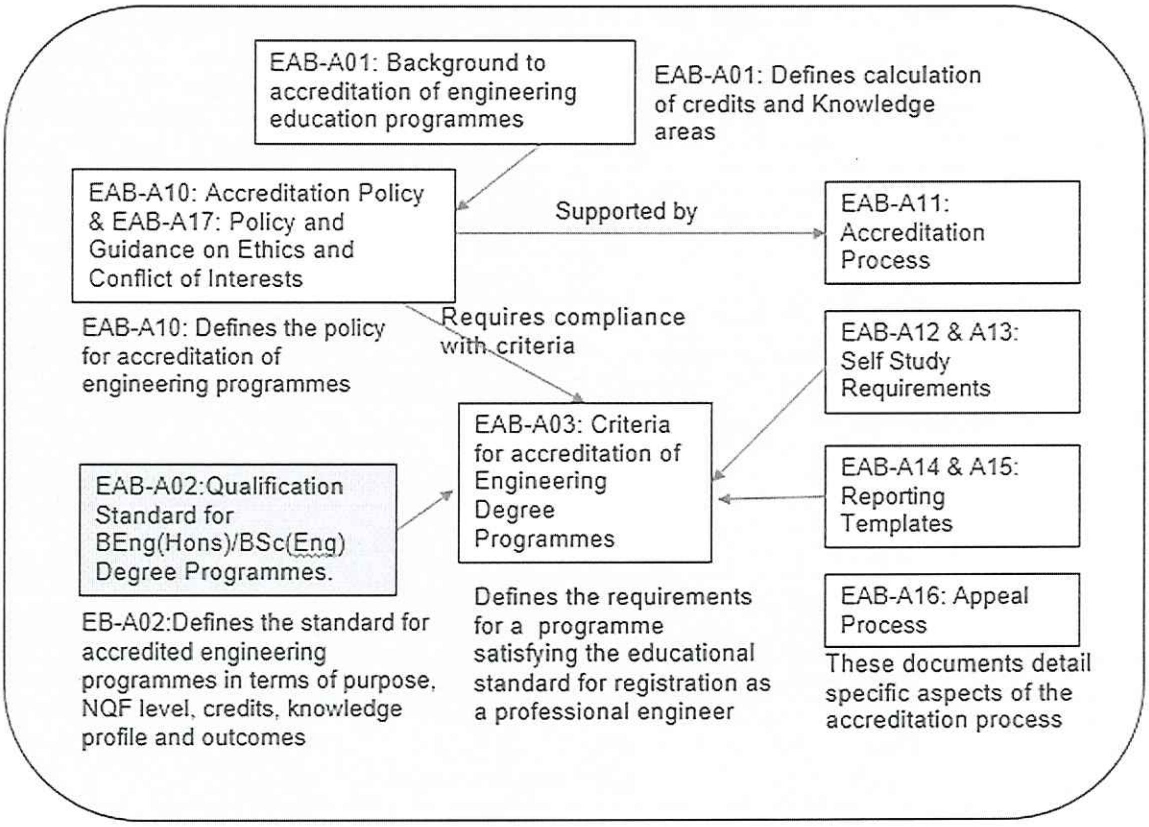

Chart EAB-A02

2. Benefits of Accreditation of Engineering Degree Programmes

The accreditation objectives of an engineering degree programme have been adequately identified in Sections 2 and 4 of the document **EAB-A01-P:** ***Background to Accreditation of Engineering Degree Programme***. The achievement of these objectives translates into the following benefits arising from accreditation:

(i) The graduate is provided with the educational foundation in engineering that meets the educational standard for registration as a Registered Professional Engineer under the laws of Mauritius;

(ii) The HEIs and their graduates obtain the assurance of international comparability of the engineering educational programmes under agreements to which IEM is a signatory, through the operation of an accreditation framework that brings out evidence of substantial equivalence between an EAB accredited programme and that of similar programmes accredited by other Washington Accord signatories;

(iii) Accreditation of an engineering degree programme boosts the quality standards of the HEIs and serves to encourage them to work towards improvement and innovation in engineering education in response to national and global needs while succeeding in boosting the reputation of the HEIs offering the accredited programme;

(iv) The HEIs concerned will receive feedback not only on deficiencies if any, vis-à-vis the standard, but on the programme weaknesses in the respective HEI's programme delivery setup;

(v) As a consequence of item (ii) above, accreditation will enhance the mobility of Mauritian Engineers having qualified from an accredited programme, and this will also impact on the quality of the engineers through international exposure;

(vi) Better performers emerging from accredited programmes will undoubtedly result in gains for the economy from a better breed of engineers, since the development, building, maintenance and upgrading of infrastructure depends on engineers for their execution, leading to a positive impact on the environment and socio-economic development and hence on quality of life of the citizens;

(vii) Enhancement of the engineers' mobility will translate into lesser economic pressure for the government since Mauritian engineers would be eligible to compete for regional and international contracts, which will add to their expertise.

3. Purpose of Document

This document defines the Standard for accredited Bachelor of Engineering (Hons)/Bachelor of Science in Engineering (Hons)-type programmes in terms of programme design criteria, knowledge profile and a set of graduate attributes.

4. National Comparability: National Qualification Framework

4.1 **NQF Exit Level:** The BEng (Hons) degree defined herein is equivalent to Level 8 of the Mauritius National Qualifications Framework Level 8 under the Mauritius Qualifications Authority Act (2001), and The Education and Training (Miscellaneous Provisions) Act (2005) for bachelor degrees with Honours, or as may be prescribed by Regulations under the Higher Education Commission under the HEA Act 2017.

4.2 The programme must be offered at an appropriate tertiary-level institution. The degree programme itself spans at least four(4) full-time academic years, or the equivalent for Part-Time basis programmes. The total duration of education at primary, secondary and tertiary levels will typically be at least sixteen years (as per Washington Accord Rules).

Note: The practices of Engineering Technologists and Engineering Technicians, respectively, are not presently regulated in Mauritius; consequently, accreditation for Sydney Accord (Engineering Technologists) and Dublin Accord (for Engineering Technicians) are currently excluded from the ambit of the EAB.

5. Accreditation Credit Units (ACU)

The term "Credit" is defined in document **EAB-A01-P** as "a measure of the volume of learning attached to a course or module calculated according to the procedure defined in the relevant standard for the type of programme; a level may be associated with an assigned number of credits."

5.1 A minimum total of 560 Accreditation Credit Units (ACU) must be achieved by the programme over four(4) academic years or eight(8) academic semesters, or the equivalent for a programme delivered on a part-time basis and should achieve not lesser than the number of equivalent Credits specified at NQF level 8 of the Mauritius National Quality Framework.

5.2 Under this system, ten (10) notional learning hours equate to one (1) Accreditation Credit Unit (ACU).

Computation of total learning hours also includes learning outside the classroom, i.e., not direct contact, tutorial hours and laboratory hours, and such learning is accounted through the application of Learning Multiplier for each of the learning or delivery methods through which the student acquires learning. Where the HEI uses a different system to compute the volume of learning in credit units it should be guided by the provisions of document **EAB-A01-P**.

6. Acceptable Titles for Engineering Degree Programmes Eligible for Accreditation by EAB

The designation of the degree and the name of the programme for which accreditation is sought must include the word "Engineering," viz.

- Bachelor of Engineering (Hons),
- Bachelor of Science in Engineering (Hons),

and must be stated precisely the same way on the graduate's Academic Transcript and in the HEI's literature; the title may not include "engineering management" notwithstanding the fact that the programme may include a module on "engineering management".

7. Abbreviations

Acceptable abbreviations for programmes seeking accreditation are:

- B.Eng(Hons),
- B.Sc(Eng)(Hons).

8. Qualifiers

The qualification must have a disciplinary or cross-disciplinary qualifier (discipline, branch, option or endorsement) defined in the provider's rules for the degree that is reflected on the academic transcript and degree certificate, subject to the following:

8.1. There must be at least one qualifier that contains the word Engineering and a disciplinary description such as: Chemical, Civil, Computer, Electrical, Electro-mechanical, Electronic, Industrial, Mechanical, Mechatronic. Qualifiers are not restricted to this list.

8.2. The qualifier(s) must clearly indicate the nature and purpose of the programme.

8.3. The qualifier must be consistent with the fundamental engineering science content on the programme.

8.4. The qualifier(s) should be comparable with typical programmes within the jurisdictions of Washington Accord countries.

8.5. The target market indicated by the qualifier may be a traditional branch of engineering or a substantial industry area. *Programmes should not address narrow niche markets.* Formal education for such markets should rather be satisfied by broad undergraduate programmes such as specified in this standard followed by specialized course-based postgraduate programmes.

9. Purpose of the Qualification

9.1 The purpose of the qualification is to build the necessary knowledge, understanding, abilities and skills required for further learning towards becoming a competent practicing engineer. The recognised purpose of a degree in engineering, accredited as satisfying the criteria, is to provide graduates with:

(i) Preparation for careers in engineering and related areas, for achieving technical leadership and contribute to the economy and national development in a sustainable manner;

(ii) The educational requirement towards registration as a Professional Engineer with the Regulatory body for engineering (CRPE) as well as to allow the graduate to make careers in engineering and related fields; the educational standard will also satisfy the educational requirements for admission into the corporate membership grades of the IEM;

(iii) A thorough grounding in mathematics, natural sciences, engineering sciences, engineering modelling, engineering design and the abilities to enable applications in fields of emerging knowledge together with an appreciation for the world and society in which engineering is practised;

(iv) For graduates with an appropriate level of achievement in the programme, the ability to proceed to postgraduate studies in both course-based and research masters programmes, and

(v) Deliver the specific objectives of the programme which are not identified within items (i) to (iv) above.

10. Programme Structure

Subject to the overall requirement for a minimum of 560 Academic Credit Units (ACU), credits must be distributed in order to create a coherent progression of learning towards the exit-level. Preparatory or remedial courses are not included in the 560 ACU.

10.1 Knowledge Areas in the Programme

When analyzed by knowledge area, the content of the programme must not fall below the minimum credits specified in each knowledge area in Table 1.

Knowledge areas are defined in Appendix A.2 of document **EAB-A01-P**.

Table-1: Total Minimum Curriculum Content by Knowledge Area

Knowledge Area	Minimum Credits
Mathematical Sciences	**56**
Natural Sciences	**56**
Engineering Sciences	**180**
Design and Synthesis	**72**
Complementary Studies	**56**
Sub-TOTAL	**420**
For Reallocation	**≥ 140**
Total CREDITS	**≥ 560**

The *for-reallocation* component must be taken up by allocating knowledge to the five knowledge areas to form a coherent, balanced programme.

10.2 Curriculum Content

10.2.1 This standard does not specify detailed curriculum content and does not intend to impose uniformity on HEIs in relation to curricula and syllabuses. Providers have the freedom to design programmes with different detailed structures, learning pathways and modes of delivery. They are encouraged to develop courses, making the best use of resources, responding to academic and technological change and recognizing the needs of the students, community and profession. However, the curriculum's breadth and depth and the teaching-learning activities should be appropriate for solving complex engineering problems in the relevant discipline.

10.2.2 The curriculum design and content must ensure the achievement of published objectives.

10.3 Complementary Studies

While the curriculum must include the specific requirements described in Section 10.4, and ensure that the engineering fundamentals and specialist engineering science content of the curriculum will be consistent with the designation of the degree and that the knowledge areas will conform to the requirements in Section 10.1, its design must include humanities and social science and ensure exposure to and acquisition of learning on the following areas of knowledge: the application of computers, user and public safety and health considerations; engineering economics; the need for designing for sustainable development; environmental stewardship; preparing students for independent learning (project and problem based), developing their communication skills and operating as an influential member of a team; technology impact on society; adhering to professional ethics; equity and law, entrepreneurship, including engineering entrepreneurship as well as International learning experiences.

10.4 Specific Requirements of the Curriculum

10.4.1 A Coherent Core

The programme must have a coherent core of mathematics, natural sciences and engineering fundamentals that provides a viable platform for further studies and lifelong learning. The coherent core must enable development in a traditional discipline or an emerging field.

10.4.2 A Specialist Content

A programme must contain a component of specialist engineering study at the exit-level. Specialist study may take on many forms, including further deepening of a theme in the core, a new sub-discipline, or a specialist topic building on the core. It is recognized that the extent of specialist study is of necessity limited given the need to provide a substantial, coherent core. Specialist study may take the form of compulsory or elective credits.

10.4.3 A minimum period of Industrial Training/Work-Based Learning

(i) The programme will include a period of Industrial Training (work-based learning), which should be conducted before the final semester. Industrial training shall be for a minimum of eight (8) weeks of continuous training.

(ii) However, ***Credits, in accordance with the quantum in (iii) may only be assigned and included in the knowledge breakdown*** if the industry attachment is subject to an Agreement between the HEI and the Training Provider, setting out the terms of the Industrial attachment of the graduate, the defined outcomes from the assignment, the respective responsibilities of the HEI/Course Supervisor and the Training Provider/Engineer assigned to the programme for the delivery of the outcomes, and that the programme is quality assured by the HEI, student's performance is comprehensively assessed against defined outcomes. This information is documented and presented in the accreditation process.

(iii) Credits may only be assigned to the industrial training up to a maximum of 20 ACU, subject to 4 ACU credits allocated for every two (2) weeks of training.

10.4.4 Laboratory Experience

(i) Application of computers and appropriate laboratory experience must be an integral component of the engineering curriculum.

(ii) Instruction in safety procedures must be included in the preparation of students' laboratory and field experience.

10.4.5 The Final Year Capstone Project

10.4.5.1 Combined Integrated Design and Research Project

(i) The Programme will be required to demonstrate that the Project is based on the knowledge and skills acquired in earlier coursework and that it has recourse to appropriate engineering standards for finding solutions to multiple constraints.

(ii) This Project may be assigned on its own, distinct from a purely Research Oriented Project, or shall be designed as a multifaceted assignment intended to deliver a culminating "capstone" academic and intellectual experience to permit attainment of several Graduate Attributes.

(iii) The Project may be designed to deliver Graduate Attributes that develop the students learning in areas referred to in Section 10.3, including engineering economics and project management and sustainability, develop and instil the engineers' responsibility and consideration for public health and safety, societal and cultural issues as well as environmental issues.

(iv) The Project may involve solutions to complex engineering problems and the design of systems, components or processes integrating core areas. Its selection and design should promote teamwork and problem-solving skills.

(v) HEIs may design the Project to deliver and assess several Graduate Attributes, which can also be delivered successfully, if the HEIs so choose to, through two- separate Integrated Design projects and a Research Project (see section 10.4.5.2.).

(vi) The Project definition must state both the likely task involved and expected objectives of the task and the Graduate Attributes whose achievements are to be demonstrated through the Project.

(vii) The programme must demonstrate that the student has had the necessary exposure to and has acquired the techniques in a literature review and acquisition of knowledge and skills in the choice and use of appropriate modern techniques and tools, including multimedia, in the delivery of the Research Project.

10.4.5.2 Research Project

Where the HEI consider it appropriate to assess the research component in a separate Research Project, the Project can reckon a maximum of 48 Accreditation Credit Units.

11. Access to Qualification

This standard is specified as a set of graduate attributes and the overall distribution of credits. Providers, therefore, have the freedom to construct programmes geared to different levels of preparedness of learners, including:

(i) Use of access programmes for learners who do not meet the minimum learning requirements;

(ii) Creating articulation paths from other qualifications.

12. Minimum Learning Assumed to be in Place

The design of a 560 ACU credit programme to meet the graduate attributes and credit requirements defined in this standard takes into consideration that entrants are proficient as specified by the provider's entry requirements in Mathematics, Physics, and reading, speaking and writing in the language of teaching and learning, and reading in English.

Note: These assumptions do not prescribe prerequisites. Sections 11 and 12 should be read together.

13. Graduate Attributes (Learning Outcomes) (GA)

The information in this Section has been drawn from the IEA <Graduate Attributes and Professional Competencies>, Approved Version 4: 21 June 2021 (available through the IEA website: http://www.ieagreements.org).

13.1 Outcome-Based Learning

(i) EAB adopts the set of Graduates Attributes (GAs) published by the International Engineering Alliance for the Washington Accord as the graduate outcomes standard to be applied for accreditation of programmes intended for satisfying the educational requirements for engaging into the practice of professional engineering prescribed by CRPE. The accreditation of any programme conforming to the same standard is an essential measure of ensuring that the programme is substantially equivalent to that advocated by the Accord, as illustrated by the Accord Graduate Exemplar. The graduate attributes are exemplars of the attributes (i.e., knowledge and understanding, skills and behavioural traits) expected of a graduate from an accredited programme that the graduate acquires while progressing through the programme and capable of being demonstrated by the graduate upon graduation.

(ii) The GAs form a set of individually assessable outcomes (identified as GA1, GA2, etc., and described in section 13.5) that are the components indicative of the graduate's potential to acquire competence to practise at the appropriate level. They are straightforward, succinct statements of the expected capability qualified, if necessary, by a range indicator appropriate to the programme type.

(iii) The differentiating characteristics of these attributes (which apply to the present standard, i.e., the Washington Accord) to be delivered through the academic curriculum, in contrast with those for the Sydney Accord (for Engineering Technologists) and the Dublin Accord (for Engineering Technicians), are in the Knowledge and Attitude Profiles (see Section 13.6) for delivery of the various respective Graduate Attributes, the Range of attributes (see Section 13.3) associated with the complexity of problems, as well as the attributes of complex engineering activities themselves (See Section 13.4).

13.2 Range and Complexity of problems

The competencies defined in the eleven (11) graduate attributes may be demonstrated in a university-based, simulated workplace context. Competencies stated generically may be assessed in various engineering disciplinary or cross-disciplinary contexts.

13.3 Range of Problem Identification and Solving

Complex Engineering problems have the characteristics of WP1 and some or all of WP2 to WP7:

(i) **WP1: Depth of knowledge required**: Cannot be resolved without in-depth engineering knowledge at the level of one or more of WK3, WK4, WK5, WK6 or WP7 (see Section 13.6) which allows a fundamentals-based, first principles analytical approach.

(ii) **WP2: Range of conflicting requirements**: Involve wide-ranging and/or conflicting technical, non-technical issues (such as ethical, sustainability, legal, political, economic, societal) and consideration of future requirements.

(iii) **WP3: Depth of analysis required**: Have no obvious solution and require abstract thinking, creativity and originality in analysis to formulate suitable models.

(iv) **WP4: Familiarity of issues**: Involve infrequently encountered issues or novel problems.

(v) **WP5: Extent of applicable codes**: Address problems not encompassed by standards and codes of practice for professional engineering.

(vi) **WP6: Extent of stakeholder involvement and conflicting requirements**: Involve collaboration across engineering disciplines, other fields, and/or diverse groups of stakeholders with widely varying needs.

(vii) **WP7: Interdependence**: Address high-level problems with many components or sub-problems that may require a systems approach.

13.4 Range of Engineering Activities (in the context of Professional Competencies): included herein for information

"Complex activities" means engineering activities or projects that have some or all of the following characteristics:

(i) **Range of Resources** (EA1): Involve the use of diverse resources, including people, data and information natural, financial and physical resources and appropriate technologies including analytical and/or design software.

(ii) **Level of Interactions** (EA2): Require optimal resolution of interactions between wide-ranging and/or conflicting technical, non-technical, and engineering issues;

(iii) **Innovation** (EA3): Involve creative use of engineering principles, innovative solutions for a conscious purpose, and research-based knowledge;

(iv) **Consequence to Society and the Environment** (EA4): Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation;

(v) **Familiarity** (EA5): Can extend beyond previous experiences by applying principles-based approaches.

13.5 The Graduate Attributes

An accredited engineering degree programme must be capable of demonstrating that every one of the students successfully completing the programme of studies is capable, on graduation, of achieving each one of the eleven (11) Graduate Attributes, listed hereinafter and identified as Graduate Attributes GA1 to GA11, and will have attained the Knowledge and Attitude Profiles defined in Section 13.6.

13.5.1 Graduate Attribute GA1: Engineering Knowledge: *Breadth, depth and type of knowledge, both theoretical and practical*

Apply knowledge of mathematics, natural science, computing and engineering fundamentals, and an engineering specialisation as specified in Section 13.6 (Knowledge and Attitude Profiles **WK1 to WK4**) respectively to develop solutions to complex engineering problems.

Range Statement: Mathematics, natural science and engineering sciences are applied in formal analysis and modelling of engineering situations and for reasoning about and conceptualising engineering problems.

13.5.2 Graduate Attribute GA2: Problem Analysis: *Complexity of analysis*

Identify, formulate, research literature and analyse complex engineering problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences-with holistic considerations for sustainable development.

Knowledge and Attitude Profile for delivery of GA2: As for GA1, e.g., WK1 to WK4.

13.5.3 Graduate Attribute GA3: Design and Development of solutions: *Breadth and Uniqueness of Engineering problems, that is, the extent to which problems are original and to which solutions have not previously been identified or codified*

Design creative solutions for complex engineering problems and design systems, components or processes to meet identified needs with appropriate consideration for public health and safety, whole-life cost, net zero carbon, as well as resource, cultural, societal and environmental considerations as required.

Knowledge and Attitude Profile for delivery of GA3: WK5.

Range Statement: Design problems used in the exit-level assessment must conform to the definition of a complex engineering problem. A significant design problem should be used to provide evidence. The design knowledge base and components, systems, engineering works, products, or processes to be designed are dependent on the discipline or practice area.

13.5.4 Graduate Attribute GA4: Investigations:–*Breadth and Depth of investigation and experimentation*

Conduct investigations of complex engineering problems using research methods including research-based knowledge, design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.

Knowledge and Attitude Profile for delivery of GA4: WK8.

Range Statement: The balance of investigation and experiment should be appropriate to the discipline. Research methodology to be applied in research or investigation where the student engages with selected knowledge in the research literature of the discipline.

> **Note:** An investigation differs from a design in that the objective is to produce knowledge and understanding of a phenomenon and a recommended course of action rather than specifying how an artifact could be produced.

13.5.5 Graduate Attribute GA5: Tool Usage*: Level of understanding of the appropriateness of technologies and tools.*

Create, select, and apply, and recognise limitations of appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems.

Knowledge and Attitude Profile for delivery of GA5: WK2 and WK6.

Range Statement: A range of methods, skills and tools appropriate to the disciplinary designation of the program, including:

1. Discipline-specific tools, processes or procedures;
2. Computer packages for computation, modelling, simulation, and information handling;
3. Computers and networks and information infrastructures for accessing, processing, managing, and storing information to enhance personal productivity and teamwork.

13.5.6 Graduate Attribute GA6: The Engineer and the World: *{Level of knowledge and responsibility}: for sustainable development.*

When solving complex engineering problems, analyze and evaluate sustainable development impacts* to society, the economy, sustainability, health and safety, legal frameworks, and the environment.

*Represented by the 17 UN Sustainable Development Goals (UN-SDG)

Knowledge and Attitude Profile for delivery of GA6: WK1,WK5, and WK7

Range Statement: The combination of social, workplace (industrial) and physical environmental factors must be appropriate to the discipline or other qualification designation. Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline:

health, safety and environmental protection; risk assessment and management and the impacts of engineering activity: economic, social, cultural, environmental and sustainability.

13.5.7 Graduate Attribute GA7: Ethics: *Understanding and level of practice*

Apply ethical principles and commit to professional ethics and norms of engineering practice and adhere to relevant national and international laws. Demonstrate an understanding of the need for diversity and inclusion.

Knowledge and Attitude Profile for delivery of GA8: WK9.

Range Statement: Evidence includes case studies typical of engineering practice situations in which the graduate is likely to participate. Ethics and the professional responsibility of an engineer and the contextual knowledge specified in the range statement of GA 6 is generally applicable here.

13.5.8 Graduate Attribute GA8: Individual and Collaborative Teamwork*: Role in and Diversity of Team*

Function effectively as an individual and as a member or leader in diverse teams and multi-disciplinary, face-to-face, remote and distributed settings.

Knowledge and Attitude Profile for delivery of GA8: WK9.

Range Statement: Multidisciplinary tasks require co-operation across at least one disciplinary boundary. Co-operating disciplines may be engineering disciplines with different fundamental bases other than that of the programme or maybe outside engineering.

13.5.9 Graduate Attribute GA9: Communication: *Level of communication according to type of activities performed*

Communicate effectively and inclusively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations taking into account cultural, language, and learning differences.

Range Statement: Material to be communicated is in an academic or simulated professional context. Audiences range from engineering peers, management and laypersons, using appropriate academic or professional discourse. Written reports range from short (300-1000 words plus tables diagrams) to long (10 000 to 15 000 words plus tables, diagrams and appendices), covering the material at the exit level. Methods of providing information include the conventional methods of the discipline, such as engineering drawings and subject-specific methods.

13.5.10 Graduate Attribute GA 10: Project Management and Finance: *Level of Management and Finance required for differing types of activity*

Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and multidisciplinary environments.

Range Statement: Basic techniques from economics, business management; project management applied to one's own work, as a member and leader in a team, to manage projects and in a multidisciplinary environment.

13.5.11 Graduate Attribute GA11: Lifelong Learning: *Duration and manner*

Recognise the need for, and have the preparation and ability for (i)-independent and life-long learning (ii) adaptability to new and emerging technologies and (iii) critical thinking in the broadest context of technological change.

Knowledge and Attitude Profile for delivery of GA11: WK8.

Range Statement: Operate independently in complex, ill-defined contexts requiring personal responsibility and initiative; accurately self-evaluate and take responsibility for learning requirements; be aware of social and ethical implications of applying knowledge in particular contexts.

13.6 Knowledge and Attitude Profiles for delivery of respective Graduate Attributes

A ***Knowledge and Attitude Profile*** **(WK)** is an indicated volume of learning and the attributes against which graduates must be able to perform.

- **WK1: Natural Sciences:** A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
- **WK2: Mathematics**: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

- **WK3: Engineering Sciences:** A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
- **WK4: Specialist Knowledge**: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
- **WK5:** Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.
- **WK6:** Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
- **WK7:** Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development*.
  (*Represented by the 17 UN Sustainable Development Goals (UN-SDG))
- **WK8**: Engagement with selected knowledge in the current research literature of the discipline~~.,~~ awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
- **WK9**: **Ethics, inclusive behaviour and conduct:** Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and inclusive attitudes

Note: *A programme that builds this type of knowledge and attitude and develops the base attributes listed below described under GA1 to 11 is typically achieved in 4 to 5 years of study, depending on the level of students at entry, in contrast with a period of 3 to 4 years for the Engineering Technologist and 2 to 3 years for Engineering Technician.*

14. International Comparability

International comparability of this whole qualification standard is ensured by applying educational standards, accreditation criteria and procedures advocated by the Washington Accord, an agreement for the mutual recognition of professionally-oriented bachelor's degrees in engineering. The standards are comparable with the Washington Accord Graduate Attributes.

Appendix A lists out the Washington Accord signatories as at the date mentioned therein.

Comparability is audited on a six-yearly cycle by a visiting Washington Accord team.

***N.B. The number of signatories to the Washington Accord is subject to change as new members meeting the requirements are registered.**

15. Integrated Assessment

Providers of programmes (HEIs) must demonstrate that an effective integrated assessment strategy is shown in the quality assurance process they have put in place. Clearly identified components of assessment must address summative assessment of the graduate attributes.

16. Recognition of Prior Learning

Providers may give recognition of prior learning at intermediate levels but must take full responsibility for assessing the graduate attributes and ensuring that every graduate has met each one of the graduate attributes.

17. Articulation Possibilities

While the graduate attributes are primarily intended to ensure that a graduate of an accredited programme meets the educational requirements for Stage-1 (Eligibility) of the registration process of the Council of Registered Professional Engineers Mauritius, the graduate might also qualify for

(i) Formal specialist study toward Postgraduate Diplomas;
(ii) Specialist coursework masters programmes;
(iii) Research masters programmes leading to master's degrees with or without coursework components, and
(iv) Such other avenues where accredited programmes are considered desirable.

18. Moderation and Registration of Assessors

Providers of programmes must have in place and demonstrate in the quality assurance process that an effective moderation process exists to ensure that the assessment system is consistent and fair.

19. Definitions and Abbreviations

See Appendices A.1, A.2 and A.3 in document **EAB-A01-P**.

20. References

1. EAB-A01-P: *Background to Accreditation of Engineering Degree Programmes.*
2. Governance Manual for the Engineering Accreditation Board
3. International Engineering Alliance: <https//www.ieagreements.org>

Appendix A: Washington Accord Signatories as at December 2020

Washington Accord signatories as of June 2019, with their date of signatory status are as follows: Australia (1989), Canada (1989), Chinese Taipei (2007), Hong Kong China (1995), China (2016), Costa Rica (2020), India (2014), Pakistan (2017), Ireland (1989), Japan (2005), Republic of Korea (2007), Malaysia (2009), Russia (2012), New Zealand (1989), Peru (2018), Singapore (2014), South Africa (1999), Sri Lanka (2014), Turkey (2011), United Kingdom (1989), and the United States of America (1989).

Appendix B: Definitions of terms

Note: These definitions, which apply to terms used in this document, are reproduced here under for convenience of the reader, *are included in Appendix A1 of EAB Document EAB-A01,*

Awareness: Recognizing the context and implications while using or applying what has been learned. The demonstration of awareness can be more varied than a demonstration of knowledge. Asking the right questions, including among the assumptions made, complying with or respecting when faced with a situation may be acceptable demonstrations.

Complementary (contextual) knowledge: Disciplines other than engineering, basic and mathematical sciences, that support engineering practice, enable its impacts to be understood and broaden the outlook of the engineering graduate.

Complex engineering problems: a class of problems with characteristics defined in section 13.3.

Complex engineering activities: a class of activities with characteristics defined in 13.4

Engineering sciences: include engineering fundamentals that have roots in the mathematical and physical sciences, and where applicable, in other natural sciences, but extend knowledge and develop models and methods in order to lead to applications and solve problems, providing the knowledge base for engineering specialisations.

Engineering design knowledge: Knowledge that supports engineering design in a practice area, including codes, standards, processes, empirical information, and knowledge reused from past designs.

Engineering discipline: synonymous with *branch of engineering.*

Engineering fundamentals: a systematic formulation of engineering concepts and principles based on mathematical and natural sciences to support applications.

Engineering management: the generic management functions of planning, organising, leading and controlling, applied together with engineering knowledge in contexts including the management of projects, construction, operations, maintenance, quality, risk, change and business.

Engineering problem: is a problem that exists in any domain that can be solved by the application of engineering knowledge and skills and generic competences.

Engineering practice area: a generally accepted or legally defined area of engineering work or engineering technology.

Engineering speciality or specialization: a generally-recognized practice area or major subdivision within an engineering discipline, for example, Structural and Geotechnical Engineering within Civil Engineering; the extension of engineering fundamentals to create theoretical frameworks and bodies of knowledge for engineering practice areas.

Engineering technology: is an established body of knowledge with associated tools, techniques, materials, components, systems or processes that enable a family of practical applications and that rely for its development and effective application on engineering knowledge and competence.

Forefront of the professional discipline/branch[1]: defined by advanced practice in the specialisations within the discipline.

Formative development: the process that follows the attainment of an accredited education program that consists of training, experience and expansion of knowledge.

Knowledge: Recognizing and comprehending terminology, facts, methods, trends, classifications, structures, or theories. It involves learning as well as demonstrating what has been learned. The demonstration of a specific knowledge is invariably by means of work done based on that knowledge.

Manage: means planning, organising, leading and controlling in respect of risk, project, change, financial, compliance, quality, ongoing monitoring, control and evaluation.

Mathematical sciences: mathematics, numerical analysis, statistics and aspects of computer science cast in an appropriate mathematical formalism.

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[1] This should be distinguished from: **Forefront of knowledge in an engineering discipline/speciality**: defined by current published research in the discipline or speciality.

Natural sciences: Provide, as applicable in each engineering discipline or practice area, an understanding the physical world including physics, mechanics, chemistry, earth sciences and the biological sciences,

Practice area: *in the educational context:* synonymous with generally-recognized engineering speciality; *at the professional level:* a generally recognized or distinctive area of knowledge and expertise developed by an engineering practitioner by virtue of the path of education, training and experience followed.

Solution: means an effective proposal for resolving a problem, taking into account all relevant technical, legal, social, cultural, economic and environmental issues and having regard to the need for sustainability.

Subdiscipline: Synonymous with *engineering speciality*.

Substantial equivalence: applied to educational programs means that two or more programs, while not meeting a single set of criteria, are both acceptable as preparing their respective graduates to enter formative development toward registration.

Well-defined engineering problems: a class of problems with characteristics defined in section 13.3
Well-defined engineering activities: a class of activities with characteristics defined in section 13.4

21. DOCUMENT REVIEW HISTORY

Date	Description	Author/Reviewer	Remarks
17-08-2018	Drafting Group	TR, HR, AA, RH	
18-10-2018	1st Draft	Combined Standard and Criteria	
19-02-2019	Amended	ACCY	
26-02-2019	Reviewed	EAB	
20-03-2019	Submitted to ECSA		
13-18-04-2019	Review at ECSA 2nd Workshop		
24-06-2019	ECSA Report Received	Comments invited	
22-09-2019	Amended Draft	Pr T Ramjeawon	
21-10-2019	Review by EAB		
05-12-2019	Amended draft (Dr ACCY & JS)	Text related to BEng Standard shifted from EAB-A03-P to A02-P & Inserted provision for both Final Yr Integrated (capstone) and Research project	
09-12-2019	Reviewed by ACCY	Submitted to EAB, EASC, SABEA, Consultative Committee.	
29-02-2020	Validation Workshop (presented by Pr TR)	Entry qualification not to be prescriptive- Separate Design Research projects, Industrial Trng mandatory, etc	

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29-07-2020	Amended for SABEA	At HEI option, Research project tobe included in Design project or separate	
13-08-2020	Amendment	Core Review Group	Section 10.4.5 amended
17-08-2020	Amendment approved	EAB	
09-09-2020	Amendment	SABEA	48 Credit Units for capstone Project
13-09-2020	Proposed amendment by EAB	Review definition of complex problems, amend to adopt Washinghon Accord Gas	
07-10-2020	Doc Amended	EAB approves	Amended Section 13
15-02-2021	Reviewed	Consultant John Cato	
15-03-2021	Edited & Reformatted	J Soobarah	Inserted Reviw History
23-03-2021	Issue 2021-1	Deoc Ref 20200817 replaced by 20210323 to reflect this date	
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05-05-2022	Review & Amend	A. Chan Chim Yuk	
02-09-2022	Reviewed by DRC		
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