Welcome to a Session on The Standard of an Engineering Degree suitable for Engaging in the Practice of Professional Engineering.

Session organised by the
ENGINEERING ACCREDITATION BORAD
An autonomous entity established by IEM

Jagadish Soobarah CEng, PEng(IEM), FRAeS, FAeSM, FIEM, RPEM

The BEng (Hons) / BSc(Eng.) (Hons) Standard

DISCLAIMER

- The IEM and EAB do NOT in any manner imply that the Engineering Degree Programmes offered by the Universite des Mascareignes (UdM), or any other HEIs in Mauritius, are sub-standard.

- EAB's interest and hopefully UdM's motivation in seeking accreditation of its engineering degree programmes is to find out if the academic standard of these degree programmes conform to that advocated by the International Engineering Alliance.

The BEng (Hons) / BSc(Eng.) (Hons) Standard

Academic Standard must satisfy the following

1. **The National Qualification Standard, currently NQF Level 8 (Honours Degree Programmes)**
2. **The standard for accreditation by the HEC as set down in Section 17 of HEC Act (2017), understood to be that set by CRPE**
3. **The CRPE standard for Stage-1 of Registration with CRPE Section 13 of the CRPE Act.**
4. **The standard set by IEM for admission into the Corporate Grades (AMIEM, MIEM, FIEM),**
5. **The academic standard advocated by Washington Accord for professional engineering practice.**

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- QUESTION? Are the Programmes of different WA members Equivalent?: The answer:-
- The agreement (Accord) provides that Every member shall recognise engineering programmes accredited by every other member as from the time the members have been admitted as signatory of the Accord for entry into the practice of engineering in its own jurisdiction.
- **The academic standard of programmes accredited by any member is deemed to be *substantially equivalent* to that of programmes accredited by any other member.**
- The Reference is set by W.A *Graduate Attributes*

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Purpose of the Qualification

- **B**uild the necessary knowledge, understanding, abilities and skills required for further learning required of a practicing engineer.
- Prepare graduates for careers in engineering, technical leadership and contributing to the sustainable economic development;
- Ensure graduates have the grounding in mathematics, natural sciences, engineering sciences, engineering modelling and design, emerging knowledge, and the capacity to achieve the standards that would be demanded of them after graduation whatever the career they choose, including further studies.

The BEng (Hons) / BSc(Eng.) (Hons) Standard

Source Document: **Doc EAB-A02: Qualification Standard for BEng (Hons) / BSc (Eng.)(Hons) Degree**

Defines the standard for Accredited Degree programmes in terms of

- - **permitted qualification designation**
  - **programme design criteria**
  - **a knowledge profile; and**
  - **a set of graduate attributes.**

➢ .

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National Qualifications Framework Level 8 www.mqa.mu/English/Qualifications/Pages/NQF-Descriptor.aspx

- Defined in terms of 5 statements of knowledge, understanding and abilities that graduates must have, and 4 ability statements on application of knowledge and techniques, analyse and solve problems, communicating problems, solutions to specialist and non specialist audiences
- Four (4) statements on qualities and transferable skills for decision making, etc
- The Descriptors can be mapped against the G.As

The BEng (Hons) / BSc(Eng.) (Hons) Standard

Make-up of the BEng Standard

1. Accreditation Credit Units (volume of Study)

   Class room lectures

   + tutorial + Laboratory+ Project work

   + Learning away from faculty + assessment

   = Min 5600 nominal hours or 560 A.C.U

   Over 4 academic years or 8 Semesters

Malaysia: 5400 hours

UK- MEng (4 Years)-480 Units (4800 Hours ?)

ECTS- 4-Years (240 Units)-6000-7200 hours

Canada- 4 years (1950 Contact hours)

Make-up of the BEng Standard

Acceptable titles for engineering programmes

The word "Engineering" must be in the name, and be identical in HEI's literature and Student's academic transcript

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

Abbreviations for Name of Programme/Degree

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

Make-up of the BEng Standard

Discipline qualifier

The Qualifier, Viz. Chemical, Civil, Computer, etc. with Engineering must indicate the purpose and nature of programme

Consistent with the fundamental engineering science content on the programme.

Programmes should not address narrow niche markets. Achieve this by specialized course-based postgraduate programmes.

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Programme Structure
Total Minimum content by Knowledge Areas

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

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PROGRAMME STRUCTURE [See TABLE]

Content of programme in any knowledge area must NOT be lesser than Minimum specified

Knowledge Areas defined in Appendix 2 of Document **EAB-A01-P**: *Background to Engineering Programme Accreditation.*

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

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Curriculum Content

- EAB standard does not specify detailed curriculum content
- No requirement for uniformity on curricula and syllabuses.
- HEIs are free to design programmes with different detailed structures, learning pathways and modes of delivery.
- HEIs 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.
- The curriculum's breadth and depth and the teaching-learning activities should be appropriate for solving complex engineering problems in the relevant discipline.

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COMPLEMENTARY STUDIES: In additional to specific requirements for the Curriculum, it must include:

humanities and social science; 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; etc;

[independent learning; developing their communication skills; operating as a Team leader; societal impact of technology; professional ethics; equity and law, entrepreneurship, etc.]

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Specific Requirements of Curriculum

A Coherent Core

A Specialist Content

Industrial Training (Work based learning)

Laboratory Experience

The Final Year (Capstone Project)/Research Project

The Coherent Core

- mathematics,
- natural sciences and
- engineering fundamentals

- To provide graduate with a viable platform for further studies and lifelong learning.

- The coherent core must enable development in a traditional discipline or an emerging field

A Specialist Content

Must be Included in curriculum at exit-level.

Specialist study may be of nature of:

- further deepening of a theme in the core,
- a new sub-discipline, or
- a specialist topic that builds on the core.

It strengthens the coherent core.

Specialist study may take the form of compulsory or elective credits.

Industrial Training/Work-Based Learning

(i) Undertaken before the final semester. Min: (8) weeks.

(ii) ***Credits may be only be assigned :***

- if training is subject to an Agreement between the HEI and the Training Provider, stating 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.

Industrial Training / work-Based Learning [Cont'd]

This information is documented and presented in the accreditation process.

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.

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 preparation of student's laboratory and field experience.

The Final Year Capstone Project :

Combined Integrated Design and Research Project

1. The Programme must demonstrate that the knowledge and skills acquired in earlier coursework will be required and that it has recourse to appropriate engineering standards for finding solutions to multiple constraints.

2. 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

The Final Year Capstone Project : [integrated Project]

3. The Project may be designed to deliver Graduate Attributes that additionally develop the students learning in Complementary knowledge areas.
4. The Project may involve solutions to complex engineering problems and the design of systems, components or processes integrating core areas.
5. Its selection and design should promote teamwork and problem-solving skills.

The Final Year Capstone Project : [integrated Project]

6. HEIs may design the Project to deliver and assess several Graduate Attributes, through separate Integrated Design Project and a Research Project

7. 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.

The Final Year Capstone Project : [integrated Project]

8. 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.

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.

Access to Qualification

This standard is intended to be achieved by students with the appropriate entry educational level, viz. proficiency in Mathematics, Physics, and reading, speaking and writing in the language of teaching and learning, and reading in English.

Providers, therefore, have the freedom to construct programmes geared to different levels of preparedness of learners, including:

- Use of access programmes for learners who do not meet the minimum learning requirements;
- Creating articulation paths from other qualifications.

GRADUATE ATTRIBUTES: Outcome Based Learning

Outcome Based Education [OBE]

➔A shift from Input based teaching and learning to Output based education.

➔ OBE is a student-centric teaching and learning methodology

GRADUATE ATTRIBUTES-1:

(i) The Graduates Attributes (GAs) published by IEA for the Washington Accord are 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.

(ii) They are exemplars of the attributes (i.e., knowledge and understanding, skills and behavioural traits) expected of a graduate from an accredited programme. The graduate acquires while progressing through the programme and capable of being demonstrated by the graduate upon graduation.

GRADUATE ATTRIBUTES-2:

(i) The Gas comprise twelve (12) individually assessable outcomes indicative of the graduate's potential to acquire competence to practise at the appropriate level.

(ii) The GAs for Washington Accord for Prof Engineers, Sydney Accord for Engineering Technologists, and Dublin Accord for Engineering Technicians differ in the Knowledge Profiles for delivery of the various respective Graduate Attributes, the Range of attributes) associated with the complexity of problems, as well as the attributes of complex engineering activities themselves.

Range of COMPLEX PROBLEMS: (Under Washington Accord)

1. Depth of knowledge required

Problems cannot be resolved without in-depth engineering

2. **Range of conflicting requirements**

Involve wide-ranging or conflicting technical, engineering and other issues.

3. Depth of analysis required

Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models.

4. Familiarity of issues

Involve infrequently encountered issues.

Range of COMPLEX PROBLEMS: (Under Washington Accord)

5. Extent of applicable codes

Are outside problems encompassed by standards and codes of practice for professional engineering.

6. Extent of stakeholder involvement and conflicting requirements

Involve diverse groups of stakeholders with widely varying needs

7. Interdependence

Are high-level problems including many component parts or sub-problems.

COMPLEX ACTIVITIES have some or all these characteristics

1. **Range of Resources:**

Involve the use of diverse resources, including people, money, equipment, materials, information and technologies;

2. **Level of Interactions**:

Require resolution of significant problems arising from interactions between wide-ranging or conflicting technical, engineering or other issues;

3. **Innovation**:

Involve creative use of engineering principles and research-based knowledge in novel ways;

COMPLEX ACTIVITIES may have some or all these characteristics

4. Consequence to Society and the Environment

Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation;

5. **Familiarity**

Can extend beyond previous experiences by applying principles-based approaches.

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The GRADUATE ATTRIBUTES

GA1 : Application of Scientific and Engg Knowledge [WK1-4]
GA 2: Problem Analysis (complexity of analysis) [WK1-4]
GA 3: Design/ development of solutions [WK5]
GA 4: Investigation [WK8]
GA 5: Modern tool usage [WK6]
GA 6: The engineer and society [WK7]
GA 7: Environment and sustainability [WK7]
GA 8: Ethics [WK7]
GA 9: Individual and teamwork
GA 10: Communication
GA 11: Project management and finance
GA 12 : Life-long learning

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The KNOWLEDGE PROFILES

- **WK1: Natural Sciences**
- **WK2: Mathematics**
- **WK3: Engineering Sciences**
- **WK4: Specialist Knowledge**: 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 that supports engineering design in the practice area.

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The KNOWLEDGE PROFILES

- **WK6:** Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
- **WK7:** Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the professional responsibility of an engineer to public safety; the impacts of engineering activity: economic, social, cultural, environmental and sustainability.
- **WK8**: Engagement with selected knowledge in the research literature of the discipline.

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Other aspects of the Standard

1. International Comparability
2. Integrated Assessment /Quality Assurance

   an effective integrated assessment strategy is demonstrated in the quality assurance process in place
3. Recognition of Prior learning

   HEI to assume responsibility for assessing the GAs
4. Articulation possibilities

   Further academic pursuits
5. Moderation and Registration of Assessors

   Quality assurance process that an effective moderation process exists to ensure that the assessment system is consistent and fair.

END OF PRESENTATION
on
An Introduction to
The BEng(Hons) / BSc(Eng)(Hons) Standard

Thank You for Your attention.

The 4 Principles of Outcome Based Education [William G Spady]

[Reproduced from <https:// www.ascd.org/el/articles/on-outcome-based-education-a-conversation-with-bill-spady> by Ron Brandt Dec-1 1992] acknowledged with thanks

How is outcome-based education different?

OBE can be defined in terms of four principles.

1. Clarity of focus : "All curriculum design, instructional delivery, and assessment design is geared to what we want the kids to demonstrate successfully at the "real" end—not just the end of the week, the end of the semester, the end of the year—but the end of their time with us."

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2. *Expanded opportunity, i.e* "expanding the ways and number of times kids get a chance to learn and demonstrate, at a very high level, whatever they are ultimately expected to learn".

3. *High expectations,* which "means getting rid of the bell curve; We don't want bell curve standards, expectations, and results; we want all kids able to do significant things well at the end."

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4. *Design down:* "design curriculum back from where you want your kids to end up".

What's your definition of outcomes?

"In its briefest form, an outcome is a culminating demonstration of learning. It is a demonstration: what it is the kids will actually do. Most people have thought over the years that the outcomes were the curriculum content: What will the kids know? What can they recall on a test? But outcomes are not content, they're performances. One of my major points is that outcomes occur at the end".