

### 3.0 Programme Objectives

Programme Objectives are specific goals consistent with the mission and vision of the IHL, are responsive to the expressed interest of programme stakeholders, and describe the expected achievements of graduates in their career and professional life a few years after graduation.

An engineering programme seeking accreditation shall respond to the following requirements:

- (i) **Programme Objectives:** The programme shall have published Programme Objectives.
- (ii) **Processes and Results:** The programme shall have a clear linkage between Programme Objectives and Programme Outcomes (Section 4.0); a process of on-going assessment and evaluation that demonstrates the achievement of Programme Objectives with documented results; and evaluation results that are used in the continual improvement of the programme.
- (iii) **Stakeholders Involvement:** The IHL/faculty shall provide *evidence of stakeholder involvement with regard to (i) and (ii) above.*

**Note:** A programme being accredited for the first time is not required to provide evidence on achievement of Programme Objectives. Graduates of this programme are yet to start their career and reasonable time is expected before they acquire the targeted objectives.

**Note:** Please refer to Guidelines for Evaluation Panel for interpretation of requirements in this section.

### 4.0 Programme Outcomes

Programme Outcomes are statements that describe what students are expected to know and be able to perform or attain by the time of graduation. These relate to the skills, knowledge, and behaviour that students acquire through the programme.

Students of an engineering programme are expected to attain the following:

- (i) **Engineering Knowledge** - Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialisation to the solution of complex engineering problems;

- (ii) **Problem Analysis** - Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences;
- (iii) **Design/Development of Solutions** - Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations;
- (iv) **Investigation** - Conduct investigation into complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions;
- (v) **Modern Tool Usage** - Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities, with an understanding of the limitations;
- (vi) **The Engineer and Society** - Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice;
- (vii) **Environment and Sustainability** - Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development;
- (viii) **Ethics** - Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice;
- (ix) **Communication** - Communicate effectively 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, and give and receive clear instructions;
- (x) **Individual and Team Work** - Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments;
- (xi) **Life-long Learning** - Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

The range of **complex problem solving** and **complex engineering activities** is given in the tables of Section (e) Definition of Complex Problem Solving; and Section (f) Definition of Complex Engineering Activities in Appendix B respectively.

**(e) Definition of Complex Problem Solving**

The range of **complex problem solving** as required by the Programme Outcomes in Section 4.0 is defined as follows:

	Attribute	Complex Problems
1	Preamble	Engineering problems which cannot be resolved without in-depth engineering knowledge, much of which is at, or informed by, the forefront of the professional discipline, and have some or all of the following characteristics listed below:
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	Depth of knowledge required	Requires research-based knowledge much of which is at, or informed by, the forefront of the professional discipline and which allows a fundamentals-based, first principles analytical approach.
5	Familiarity of issues	Involve infrequently encountered issues
6	Extent of applicable codes	Are outside problems encompassed by standards and codes of practice for professional engineering.
7	Extent of stakeholder involvement and level of conflicting requirements	Involve diverse groups of stakeholders with widely varying needs.
8	Consequences	Have significant consequences in a range of contexts.
9	Interdependence	Are high level problems including many component parts or sub-problems.

**(f) Definition of Complex Engineering Activities**

The range of **complex engineering activities** is defined as follows:

	Attribute	Complex Activities
1	Preamble	Complex activities means (engineering) activities or projects that have some or all of the following characteristics listed below:
2	Range of resources	Involve the use of diverse resources (and for this purpose, resources include people, money, equipment, materials, information and technologies).
3	Level of interaction	Require resolution of significant problems arising from interactions between wide-ranging or conflicting technical, engineering or other issues.
4	Innovation	Involve creative use of engineering principles and research-based knowledge in novel ways.
5	Consequences to society and the environment	Have significant consequences in a range of contexts, characterised by difficulty of prediction and mitigation.
6	Familiarity	Can extend beyond previous experiences by applying principles-based approaches.

**(g) Knowledge Profile**

The curriculum shall encompass the **knowledge profile** as summarised in the table below:

Knowledge Profile
A systematic, theory-based understanding of the natural sciences applicable to the discipline (e.g. calculus-based physics)
Conceptually-based mathematics, numerical analysis, statistics and formal aspects of computer and information science to support analysis and modelling applicable to the discipline
A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline
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
Knowledge that supports engineering design in a practice area
Knowledge of engineering practice (technology) in the practice areas in the engineering discipline
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
Engagement with selected knowledge in the research literature of the discipline