

## The Mechanical Engineering Benchmark:

### 1. Introduction

The Mechanical Engineering Profession is a discipline which has made a major positive impact on society by providing mechanical facilities and devices in many fields such as transportations, machines, automations, human welfare facilities like air conditioning and heating, water managements, and fire fighting systems, yet it is seldom defined in a manner which covers all its contributing activities.

Mechanical Engineering is a profession directed towards the application of the Mechanical Engineering body of knowledge (Solids, Fluids, and thermal design) which is based on mathematics, science and technology and integrated with business and management, which is acquired through education and professional formation in mechanical engineering discipline. Mechanical Engineering is directed towards developing, providing and maintaining solutions for, industry and the community.

The outcome of Mechanical Engineering is a product that can be distinguished from Science and Mathematics, and, its outcome can be described as follows.

The primary purposes of the Benchmarking Statements are to assist:

- Higher education institutions in designing and validating programs of study.
- Academic reviewers and external examiners in verifying and comparing standards.
- Where appropriate, professional bodies during accreditation and review process.
- Students and employers when seeking information about higher education provision.

*Table 1: Criteria of content of Mechanical Engineering Program:*

<b>Mechanical Engineering practice</b>	
<i>knowledge and understanding of</i>	<ul style="list-style-type: none"><li>▪ manufacturing and/or operational practice</li><li>▪ codes of practice and the regulatory framework</li><li>▪ requirements for safe operation</li></ul>
<i>Intellectual abilities</i>	<ul style="list-style-type: none"><li>▪ ability to produce solutions to problems through the application of Mechanical Engineering</li><li>▪ knowledge and understanding ability to undertake technical risk evaluation</li></ul>
<i>Practical skills</i>	<ul style="list-style-type: none"><li>▪ ability to apply Mechanical engineering techniques taking account of industrial and commercial constraints</li><li>▪ project management</li></ul>
<i>General transferable skills</i>	<ul style="list-style-type: none"><li>▪ the Mechanical engineering approach to the solution of problems</li><li>▪ time and resource management</li><li>▪ teamwork and leadership</li></ul>

## **2. Assessment**

In developing an assessment strategy some key factors should be considered:

- There must be sufficient and clearly identified opportunities for students to demonstrate that they have met the threshold in all components of the benchmark.
- Achievement of threshold standards may, in some cases, be implicit in the learning process (E.g. the completion of a project may demonstrate attainment of some general transferable skills);
- Achievement of threshold standards should be possible without an individual student being required to pass all units of assessment. For example, a particular unit may include the assessment of only one element of the benchmark. A student may achieve the threshold in this element but not achieve a pass mark in the unit as a whole.
- Careful selection from a wide range of assessment methods can make the process more efficient and effective;
- It is important that the strategy provides sufficient opportunity for the best students to exhibit the level of innovation and creativity associated with excellence.

## **3. Recommendations**

- The Benchmark Statements set out in Table 2 and based upon the rationale provided by the criteria for content above should be used to guide the academic review of programs in mechanical engineering.
- Individual disciplines within mechanical engineering should use the generic criteria of content in Table 1 to provide an interpretation of content and balance of attainment for their own discipline.
- Professional Mechanical Engineering Institutions when setting criteria for their discipline and for the sections of the Mechanical Engineering Council Register, for which they hold responsibility, should relate them to the generic criteria and the appropriate discipline-specific interpretation.

Table 2: Benchmark Statements:

	<b>Threshold</b>	<b>Good</b>	<b>Excellent</b>
<p><b>Mechanical Engineering practice</b></p> <p><b>Knowledge and understanding of</b></p> <ul style="list-style-type: none"> <li>▪ Manufacturing and/or operational practice</li> <li>▪ Codes of practice and the regulatory framework</li> <li>▪ Requirements for safe operation</li> </ul>	<p>has a basic knowledge of current practice</p> <p>has knowledge of specific codes of practice in routine problems, including the role of design factors</p> <p>has a basic knowledge of codes of practice relating to hazards and operational safety</p> <p>understands the need for operational safety by design and good working practices</p>	<p>has a wide knowledge and good understanding of current practice</p> <p>has knowledge and some understanding of specific codes of practice, with some understanding of the limitations of the techniques and design factors involved</p> <p>has knowledge and understanding of codes of practice relating to hazards and operational safety and can apply these to familiar and some unfamiliar situations</p>	<p>has a comprehensive understanding of current practice, its limitations, and likely new developments</p> <p>has understanding of appropriate codes of practice, with wide understanding of the limits of the code and design factors involved</p> <p>has a comprehensive knowledge and understanding of codes of practice relating to hazards and operational safety, and can apply these to a wide range of situations</p>
<p><b>Intellectual abilities</b></p> <ul style="list-style-type: none"> <li>• Ability to produce solutions to problems through the application of mechanical engineering knowledge and understanding</li> <li>• Ability to undertake technical risk evaluation</li> </ul>	<p>can integrate knowledge of mathematics, science, information technology, design, and mechanical business context and mechanical engineering practice to solve routine problems as taught</p> <p>can evaluate typical technical risks, using the appropriate tools as taught</p>	<p>can integrate knowledge of mathematics, science, information technology, design, business context and mechanical engineering practice to solve a wide range of mechanical engineering problems applying profound understanding to novel and challenging situations, is aware of limitations of solution methods</p> <p>can evaluate technical risks, even in some unfamiliar circumstances</p>	<p>can integrate knowledge of mathematics, science, information technology, design, business context and mechanical engineering practice, to solve a wide range of mechanical engineering problems applying profound understanding to novel and challenging situations, is aware of limitations of solution methods</p> <p>can make general evaluations of technical risks, through an</p>

<p><b>Practical skills</b></p> <ul style="list-style-type: none"> <li>• Ability to apply mechanical engineering techniques taking account of industrial and commercial constraints</li> <li>• Project management</li> </ul>	<p>has some experience of applying mechanical engineering techniques taking account of commercial and industrial constraints</p> <p>can develop a project plan, identifying the resource requirements, and the timescales involved</p>	<p>has experience of applying mechanical engineering techniques taking account of a range of commercial and industrial constraints</p> <p>can apply standard management techniques to plan and allocate resources to projects</p>	<p>understanding of the basis of such risks</p> <p>has experience of applying mechanical engineering techniques taking account of a wide range of commercial and industrial constraints can develop, monitor and update a plan, to reflect a changing operating environment</p>
<p><b>General transferable skills</b></p> <ul style="list-style-type: none"> <li>• The mechanical engineering approach to the solution of problems</li> <li>• Time and resource management</li> <li>• Teamwork and leadership</li> </ul>	<p>can solve some general problems through systematic analysis and design methods</p> <p>can develop a personal plan of work to meet a deadline and to identify the main external constraints</p> <p>can work as part of a team</p>	<p>can solve some general problems through systematic analysis and design methods and where necessary learn new theories, concepts, methods etc in an unfamiliar situation outside the discipline area</p> <p>can identify the critical activities within a personal plan of work</p> <p>can undertake many of the roles within a team</p>	<p>can solve some general problems through systematic analysis design and planning, and where necessary, learn new theories, concepts, methods etc in an unfamiliar situation outside the discipline area</p> <p>can monitor and adjust a personal program of work on an on-going basis</p> <p>can undertake most of the roles within a team including leadership</p>