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IET Academic Accreditation

IET Academic Accreditation: AHEP 4 - The Small Print

At first sight AHEP4 appears to be a lot more straightforward than AHEP3. For a start there are far fewer learning outcomes (LOs) in AHEP4 compared with AHEP3:

Accreditation Level	AHEP3	AHEP4	AHEP4 Code Prefix
Partial IEng	--	18	F
IEng Top Up	--	9	B
Full IEng	29	18	B
Partial CEng	32	18	C
CEng Further Learning	23	8	M
Full CEng	42	18	M

In many ways this is true.

- There is far less overlap and the LOs are much clearer and demonstrable.
- The LOs form an orthogonal set with each of the 18 AHEP4 LOs applying to all the accreditation levels. There are *always* 18 LOs except that some of the 18 are expected to have been “achieved at previous level of study” in further-learning and top-up degrees.
- The AHEP4 numbering scheme is consistent across all accreditation levels, distinguished by a prefix letter given in the table above. (For example, the LO concerning teamwork is number 16 for all levels of accreditation.)
- Where not achieved at the previous level, the LOs for top-up and further-learning degrees are *identical* to those for full IEng or full CEng degrees respectively.

However, in addition to the two well publicised new LO areas, *Security and Equality, Diversity and Inclusion (EDI)*, there are many small changes that actually extend the expected attributes of graduates. This makes AHEP4 a significantly more demanding standard than AHEP3!

Problem solving is an activity that runs through this standard. A significant difference between IEng and CEng LOs is that IEng LOs deal with *broadly-defined problems* while CEng LOs deal with *complex problems*. The standard defines these as:

- “**Broadly-defined problems** involve a variety of factors which may impose conflicting constraints, but can be solved by the application of engineering science and well-proven analysis techniques.”
- “**Complex problems** have no obvious solution and may involve wide-ranging or conflicting technical issues and/or user needs that can be addressed through creativity and the resourceful application of engineering science.”

“Problems” is a key word that should be interpreted in the widest sense of any engineering endeavour.

Although not explicitly mentioned in AHEP4, the Revised Bloom’s Taxonomy underlies the themes in AHEP4. (The cognitive processes in the revised Bloom’s taxonomy are classified by the key verbs **remember**, **understand**, **apply**, **analyse**, **evaluate** and **create** in ascending order.) Compared with AHEP3, AHEP4 places much greater emphasis on the higher level cognitive processes to **evaluate** and to **create**.

A mapping between the AHEP4 LOs and the corresponding AHEP3 LOs can be found at:
<https://www.engc.org.uk/media/3411/mapping-learning-outcomes-ahp4-vs-ahp3.xlsx>

The following table highlights the significant changes in AHEP4 compared with AHEP3. In addition, with respect to Bloom's Taxonomy, the table compares the dominant cognitive process involved in the AHEP4 LO with that in the corresponding AHEP3 LOs.

AHEP4 Area of Learning	Comments
Science and Mathematics	
1: Science, mathematics and engineering principles	<p>Very large number of AHEP3 LOs have been merged into a single AHEP4 LO. The emphasis in AHEP4 is the ability to apply the knowledge, not merely understand it. Pertains to IEng through to Full CEng, the difference being the depth of knowledge.</p> <p>AHEP4 raises the cognitive process up from 'to understand' to 'to apply'.</p>
Engineering Analysis	
2: Problem analysis	<p>The AHEP4 LOs require substantiated conclusions to be drawn from the analysis. So engineering judgement must be applied. This pertains to qualitative as well as quantitative analysis.</p> <p>Technical uncertainty not mentioned for IEng or Partial CEng in AHEP4.</p> <p>AHEP4 raises the dominant cognitive process up from 'to analyse' to 'to evaluate'.</p>
3. Analytical tools and techniques	<p>For partial CEng, the AHEP4 LOs requires recognition of the limitations of the techniques employed while for full CEng the LO requires these to be discussed. (It is not clear how recognition can be assessed without it being discussed.)</p> <p>The dominant cognitive process is 'to evaluate' for both AHEP3 and AHEP4.</p>
4. Technical Literature	<p>The AHEP4 LOs require [not just technical] literature to be evaluated i.e. to judge the veracity and relevance of the information to the problem.</p> <p>The complexity of the problem distinguishes the different levels of accreditation.</p> <p>AHEP4 raises the dominant cognitive process up from 'to understand' to 'to evaluate'.</p>
Design and Innovation	
5. Design	<p>Very large number of AHEP3 LOs have been merged into a single AHEP4 LO. AHEP3 D6 not included in the mapping as it is covered in AHEP4 17. In any case it was effectively duplicated by GSa.</p> <p>The design of solutions (not necessarily a product) is central to the AHEP4 LO.</p> <p>Management of the process and dealing with uncertainty is only implicit in these AHEP4 LOs. (But project management is covered in AHEP4 LO 15.)</p> <p>In AHEP4, IEng and partial CEng distinguished by the complexity of the design problem. Full CEng LO requires evidence of some originality.</p> <p>In AHEP3, the cognitive process 'to create' is submerged by the many evaluative LOs whereas in AHEP4 'to create' is clearly dominant.</p>

AHEP4 Area of Learning	Comments
6. Integrated/systems approach	<p>Systems approach now appears in the context of design.</p> <p>The AHEP4 LOs for partial CEng and full CEng are identical so there is no additional LO for CEng further learning.</p> <p>The dominant cognitive process is 'to apply' for both AHEP3 and AHEP4.</p>
The Engineer and Society	
7. Sustainability	<p><i>AHEP4 is more specific, focusing on environmental and societal impact and minimisation of adverse impacts. Full CEng includes the complete product or process life cycle.</i></p> <p>AHEP4 raises the dominant cognitive process up from 'to understand' to 'to evaluate'.</p>
8. Ethics	<p><i>The AHEP4 LOs require ethical concerns to be analysed and choices made rather than just an understanding of the issues.</i></p> <p>The AHEP4 LO is the same for all accreditation levels from IEng upwards so there is no additional LO for CEng further learning.</p> <p>AHEP4 raises the cognitive process up from 'to understand' to 'to evaluate'.</p>
9. Risk	<p><i>In AHEP4 the focus is on the use of a risk management process. In addition to identifying and evaluating risks, AHEP4 requires risk mitigation to be covered.</i></p> <p>Health and safety notices and induction sessions in the laboratories have nothing to do with this LO!</p> <p>The AHEP4 LO is the same for all accreditation levels from IEng upwards so there is no additional LO for CEng further learning.</p> <p>AHEP4 raises the dominant cognitive processes up from 'to understand' to 'to evaluate' and mitigation moves on 'to create'.</p>
10. Security	<p><i>New in AHEP4.</i></p> <p>Only the mitigation of security risks is mentioned explicitly. But any security threat must be identified first.</p> <p>The AHEP4 LO is the same for all accreditation levels from IEng upwards so there is no additional LO for CEng further learning.</p> <p>The dominant cognitive process is 'to create'.</p>
11. Equality, diversity and inclusion (EDI)	<p><i>New in AHEP4.</i></p> <p>Focus is on responsibilities and benefits of EDI. CEng LO requires adoption of an inclusive approach to engineering practice.</p> <p>The AHEP4 LOs for partial CEng and full CEng are identical so there is no additional LO for CEng further learning.</p> <p>The dominant cognitive process is 'to understand' for IEng and 'to apply' for CEng.</p>
Engineering Practice	
12. Practical and workshop skills	<p><i>In AHEP4, practical skills are expected to be applied to problem solutions – not just learned.</i></p> <p><i>The AHEP3 IEng LO required just understanding of workshop practice; AHEP4 requires this to be applied.</i></p> <p>The AHEP4 LOs for partial CEng and full CEng are identical so there is no additional LO for CEng further learning.</p> <p>The dominant cognitive process is 'to apply' for both AHEP3 and AHEP4.</p>

AHEP4 Area of Learning	Comments
13. Materials, equipment, technologies and processes	<p><i>The AHEP4 LOs require the ability to select and apply materials, equipment, technologies and processes rather than just know about them. In addition, the CEng LO requires the recognition of their limitations.</i></p> <p>The AHEP4 LOs for partial CEng and full CEng are identical so there is no additional LO for CEng further learning.</p> <p>AHEP4 raises the dominant cognitive process up from 'to understand' to 'to evaluate'.</p>
14. Quality management	<p><i>In contrast to the rather woolly AHEP3 requirement to be aware of quality issues, the AHEP4 LOs focus explicitly on systems and procedures for maintaining and enhancing quality.</i></p> <p>The AHEP4 LOs for partial CEng and full CEng are identical so there is no additional LO for CEng further learning.</p> <p>The dominant cognitive process is 'to understand' for both AHEP3 and AHEP4.</p>
15. Engineering and project management	<p>A large number of AHEP3 LOs have been merged into a single AHEP4 LO.</p> <p><i>The AHEP4 LOs move beyond mere understanding of management techniques to being able to apply them. Relevant legal matters are covered in these LOs. The CEng LOs explicitly cover IPR.</i></p> <p>The AHEP4 LOs for partial CEng and full CEng are identical so there is no additional LO for CEng further learning.</p> <p>AHEP4 raises the dominant cognitive process up from 'to understand' to 'to apply'.</p>
16. Teamwork	<p>These AHEP4 LOs subsume many additional general skills.</p> <p>The full CEng LO requires the ability to evaluate the effectiveness of own and team performance.</p> <p>AHEP4 raises the dominant cognitive process up from 'to apply' to 'to evaluate' for full CEng.</p>
17. Communication	<p>More general application of communication skills than just in the context of design.</p> <p><i>In AHEP4, communication is expected to be two-way: 'with' not 'to' as in AHEP3.</i></p> <p>The full CEng LO expects that the effectiveness of methods used to be evaluated.</p> <p>The dominant cognitive process is 'to apply' for both AHEP3 and AHEP4 but, for full CEng it is raised to 'to evaluate' in AHEP4.</p>
18. Lifelong learning	<p><i>This LO brings into the light a LO than was buried in the additional general skills and was often overlooked.</i></p> <p><i>It would be covered by students keeping up some form of a personal development record through their programme.</i></p> <p><i>But how would this be assessed? Would it be reasonable for personal tutors to attest that the record is kept up-to-date? Then how would this be recorded?</i></p> <p>The AHEP4 LO is the same for all accreditation levels from IEng upwards so there is no additional LO for CEng further learning.</p> <p>The dominant cognitive process is 'to evaluate' for both AHEP3 and AHEP4.</p>

Note that references to full CEng include CEng further learning since their LOs are always the same.

Observations

From the table above, it can be seen that:

- There has been a lot of movement in the AHEP4 table of LOs with many AHEP3 LOs merging into AHEP4 LOs across different learning area categories. (For example, EP4 has moved from Engineering Practice to Engineering Analysis.)
- If the CEng further learning LO is “achieved at previous level of study”, the partial CEng and full CEng LOs are identical. The same goes for IEng top-up, partial IEng and full IEng.
- The verbs used by the AHEP4 LOs are active and demonstrable (with the possible exception of ‘to recognise’).
- In half the areas of learning, the key distinction between CEng and IEng LOs is that the IEng LOs are concerned with “broadly defined problems” while CEng LOs deal with “complex problems”.
- In the majority of LOs, AHEP4 raises the level of Bloom’s cognitive process involved compared with the corresponding AHEP3 LOs. For example, ‘to understand’ has been raised to ‘to apply’ twice and ‘to evaluate’ 4 times.
- Overall, of the 18 AHEP4 LOs, at least 11 are more demanding than the equivalent in AHEP3.

AHEP4 Punchlines

The following imperative one-liners are intended as a way of remembering the major thrust of each AHEP4 LO:

1. Must **apply** science and mathematics principles – not just know about them.
2. Don’t just analyse – **make judgements** based on the analysis.
3. Recognise and discuss analytical tools and techniques
4. Don’t accept everything read – **evaluate it**.
5. Solving problems, not just products, is design.
6. Adopt a systems approach to solving problems.
7. **Evaluate** environmental and societal impact and **minimise adverse impacts**.
8. Make ethical **choices** in the light of professional codes of conduct.
9. Use a **risk management process** to identify, **evaluate** and **mitigate** risk.
10. **Mitigate** security risks – not just know about them.
11. Recognise the **responsibilities** and **benefits** of EDI – and **practice inclusivity**.
12. Use practical skills to investigate problems.
13. **Select** and **apply** materials, equipment, technologies and processes.
14. Recognise and discuss the role of **quality management systems**.
15. **Apply** management principles – not just know about them.
16. Function as a team member or leader.
17. Communicate **with** both technical and non-technical audiences.
18. **Plan** and **record** professional self-development.

These statements are intended just to highlight the key import of each LO. They are not a substitute for the LOs themselves which distinguish between the different levels of accreditation.