  

**UNESCO IEA WFEO Working Group – Review of IEA Graduate Attribute and Professional Competency Framework (GAPC)**

**Graduate Attributes and Accreditation of Engineering Education Programs**

This preamble is intended to outline the activity of accreditation in engineering education and to briefly explain the IEA Graduate Attributes and their function in accreditation.

There are presently two types of evaluations, based on publicized criteria, of higher education institutions (universities, technical schools, etc.):

i) Institutional Evaluation or Accreditation,

ii) Program Evaluation or Accreditation.

The first evaluates the institution's organization, teaching, research, service to the community in a holistic way.

The criteria used for institutional evaluations are mostly "input based," i.e., they essentially describe the expected quantity and quality of the resources of the institution.

The second focuses on a discipline-specific program offered by the institution and evaluates the effectiveness of teaching at a minimum level.

The program accreditations in engineering are almost globally based on criteria that are "outcome based," i.e., the criteria describe what qualifications a graduate from that program is expected to have.

Each program must demonstrate that its graduates all do have these qualifications.

*Graduate attributes* form a set of individually assessable outcomes that are the components indicativeof the graduate's potential to acquire competence to practice at the appropriate level. They are stated generically and are *applicable to all engineering disciplines*.

The judgement of whether the demonstration that all graduates have the attributes is satisfactory is done by a team, consisting of experts in the discipline of the program evaluated. This is a periodic peer review that may result in accreditation (or not) of the program for a fixed period of time.

Below, there are four tables that specify a generic set of qualifications for all engineering programs that normally have a teaching duration of up to 4 or 5 years. These are

1. Range of Problem Solving capabilities
2. Range of Engineering Activities,
3. Knowledge and Attitude Profile, and
4. Graduate Attributes.

Table 1 lists in WP1 to WP7 the range of problem solving capabilities of an engineer/technologist/technician.

Table 2 lists, in EA1-EA6, a set of activities that distinguish the 4-5-year programs with engineer graduates from those that have a teaching duration of 3-4 years for technologists or 2 years, for graduating technicians.

Table 3 defines in WK1-WK9 the knowledge and the attitudes a graduate of an engineering program must have so as to be endowed with the qualifications listed by the fourth table on graduate attributes. Table 3 can be viewed as describing what the curriculum of an engineering program must contain at a minimum.

Table 4 specifies, in WA1-WA11, the qualifications (assimilated knowledge, skills, and attitudes) of an engineer/technologist/technician at the time of graduation.

**Professional Competency and The International Professional Engineers Agreement**

*Professional Competencies* refer to the competencies that need to be attained through lifelong learning and professional development to practice at the appropriate level. They are stated generically and are *applicable to all engineering disciplines*

Table 5 specifies in EC1 to EC11 the Range of Competency Profiles for a qualified engineer/technologist/technician.

**Changes proposed to the Graduate Attribute and Professional Competency Framework**

The changes cover the areas identified in the survey of IEA Signatories and WFEO members and stakeholders during December 2019 and January 2020. The six main areas identified were:

1. **Accommodate future needs of engineering professionals and the profession –** strengthen the required attributes on team work, communication, ethics, sustainability.
2. **Emerging technologies – incorporate** digital learning, active work experience, lifelong learning.
3. **Emerging and future engineering disciplines and practice areas –** whileretaining discipline independent approach, enhance the skills on data sciences, other sciences, life-long learning.
4. **Incorporate UN Sustainable Goals -** in the development of solutions that consider diverse impacts – technical, environment, social, cultural, economic, financial and global responsibility
5. **Diversity and Inclusion** – include these considerations within ways of working in teams, communication, compliance, environment, legal etc. systems.
6. **Intellectual agility, creativity and innovation** – emphasize critical thinking and innovative processes in design and development of solutions

Please refer to the report “Appendix-Summary of Responses to the Questionnaire” ([4] of References in the accompanying document WFEO-IEA-Working-Group-Report-To-IEA-GG-May-2020) on the results of the survey for further details. The last section of this accompanying document also includes a brief enumeration of the main emergent points from the survey.

The green highlights and strikethroughs below are used to indicate changes to the tables in anticipation of qualifications expected of a future (next 10 years) engineer, technologist or technician and for future engineers, technologists and technicians, in practice. A column added with red fonts are some supports and justifications for the new additions.

**Table 1** **Range of Problem Solving**

In the context of both Graduate Attributes and Professional Competencies:

| **Attribute** | **Complex Engineering Problems**  Have characteristic WP1 and some or all of WP2 to WP7: | **Broadly-defined Engineering Problems have**  characteristic SP1 and some or all of SP2 to SP7**:** | | **Well-defined Engineering Problems**  Have characteristic DP1 and some or all of DP2 to DP7: | **Reason for Change** |
| --- | --- | --- | --- | --- | --- |
| Depth of Knowledge Required | **WP1:** Cannot be resolved without in-depth engineering knowledge at the level of one or more of WK3, WK4, WK5, WK6 or WK8 which allows a fundamentals-based, first principles analytical approach | **SP1:** Cannot be resolved without engineering knowledge at the level of one or more of SK 4, SK5, and SK6 supported by SK3 with a strong emphasis on the application of developed technology | | **DP1:** Cannot be resolved without extensive practical knowledge as reflected in DK5 and DK6 supported by theoretical knowledge defined in DK3 and DK4 |  |
| Range of conflicting Requirements | **WP2:** Involve wide-ranging or conflicting technical and non-technical issues (ethical, sustainability, legal, political, economic, social) ~~engineering~~ and consideration of future requirements | **SP2:** Involve a variety of factors which may impose conflicting constraints (ethical, sustainability, legal, political, economic, social) and consideration of future requirements | | **DP2:** Involve several issues, but with few of these exerting conflicting constraints | The curriculum should encourage problem solving that takes a holistic approach and considers a range of constraints including resources and non-technical issues including impacts today and in the future. |
| Depth of analysis required | **WP3:** Have no obvious solution and require abstract thinking, creativity and originality and systems approach in analysis to formulate suitable contextual models | **SP3:** Can be solved by application of well-proven analysis techniques and models ~~systems approaches~~ | | **DP3:** Can be solved in standardised ways | The curriculum should provide opportunities for problems that encourage systems thinking and approaches. |
| Familiarity of issues | **WP4:** Involve infrequently encountered issues or novel problems | **SP4:** Belong to families of familiar problems which are solved in well-accepted ways | | **DP4:** Are frequently encountered and thus familiar to most practitioners in the practice area |  |
| Extent of applicable  codes | **WP5:** ~~Are outside~~ Address problems not encompassed by standards and codes of practice for professional engineering | **SP5:** Address problems thatmay be partially ~~outside those~~ encompassed by standards or codes of practice | | **DP5:** Address problems thatare encompassed by standards and/or documented codes of practice |  |
| Extent of stakeholder involvement and conflicting requirements | **WP6:** Involve diverse groups of stakeholders with  widely varying needs and collaboration across engineering disciplines and other fields | **SP6:** Involve several groups of stakeholders with differing and occasionally conflicting needs and from different engineering disciplines and other fields | | **DP6:** Involve a limited range of stakeholders with differing needs | The curriculum should involve/encourage problems that require collaboration across engineering disciplines and other fields to understand different perspectives and manage competing needs. |
| Interdependence | **WP 7:** Address ~~Are~~ high level problems with ~~including~~ many components ~~parts~~ or sub-problems | **SP7:** Address~~Are parts of, or~~ components of systems within complex engineering problems | | **DP7:** Address~~Are~~ discrete components of engineering systems |  |
| *In addition, in the context of the Professional Competencies* | | | | | |
| Consequences | **EP1:** Have significant consequences in a range of contexts |  | **TP1:** Have consequences which are important locally but may extend more widely | **NP1:** Have consequences which are locally important and not far-reaching |  |
| Judgement | **EP2:** Require judgement in decision making |  | **TP2:** Require judgement in decision making |  |  |

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| **Table 2 Range of Engineering Activities** | | |  |  |
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| **Attribute** | **Complex Activities** | **Broadly-defined Activities** | **Well-defined Activities** | **Reason for change** |
| Preamble | **Complex activities** means (*engineering)* activities or projects that have some or all of the following characteristics: | **Broadly defined activities** means (*engineering)* activities or projects that have some or all of the following characteristics: | **Well-defined activities** means*(engineering)* activities or projects that have some or all of the following characteristics: |  |
| Range of resources | **EA1:** Involve the use of diverse resources ~~(and for this purpose~~ ~~resources includes~~ including people, data and information, natural, financial and physical resources and appropriate technologies ~~money, equipment, materials, information and technologies~~) | **TA1:** Involve a variety of resources ~~(and for this purpose~~ including people, data and information, natural, financial and physical resources and appropriate technologies. ~~information and~~ | **NA1:** Involve a limited range of resources including people, data and information, natural financial and physical resources and appropriate technologies | The computation, analysis, and design software are inherently present in formulating an engineering problem as well as in finding an optimal solution. It is no longer an additional tool but a principal one. |
| Level of interactions | **EA2:** Require optimization of outcomes ~~resolution of significant problems~~ arising from interactions between wide- ranging or conflicting technical, engineering, socio-technical, environmental and political considerations ~~or other issues ,~~ | **TA2:** Require resolution of occasional interactions between technical, socio-technical, engineering and other considerations ~~issues,~~ of which few are conflicting | **NA2:** Require resolution of interactions between limited technical and engineering issues with little or no impact of wider considerations ~~issues.~~ | This encourages the impact of wider non-technical issues |
| Innovation | **EA3:** Involve creative use of engineering principles, innovative solutions for a conscious purpose and research-based knowledge in novel ways. | **TA3:** Involve the use of new materials, techniques or processes in non-standard ways | **NA3:** Involve the use of existing materials techniques, or processes in modified or new ways | Innovation needs a conscious purpose |
| Consequences to society and the environment | **EA4:** Have significant consequences in a range of contexts, characterized by difficulty of prediction, ~~mitigation~~ by severity of implications and by necessary mitigation measures to reduce the impact. | **TA4:** Have reasonably predictable consequences that are most important locally, but may extend more widely | **NA4:** Have consequences that are locally important and not far-reaching | Encourages a probabilistic risk-based approach to assessing the impact of solutions that are proposed. |
| Familiarity | **EA5:** Can extend beyond previous experiences by applying principles-based approaches | **TA5:** Require a knowledge of normal operating procedures and processes | **NA5:** Require a knowledge of practical procedures and practices for widely-applied operations and processes |  |

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| **Table 3 Knowledge and Attitude profile** | |  |  |
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| **A Washington Accord programme** provides: | **A Sydney Accord programme** provides: | **A Dublin Accord programme** provides: | **Reason for change** |
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| **WK1:** A systematic, theory-based understanding of the **natural sciences** applicable to the discipline and awareness of the relevant **social sciences** | **SK1:** A systematic, theory-based understanding of the **natural sciences** applicable to the sub-discipline and awareness for the relevant **social sciences** | **DK1:** A descriptive, formula-based understanding of the **natural sciences** applicable in a sub-discipline and awareness for the relevant **social sciences**  . | Curriculum may contain appropriate i) basic natural science courses and ii) some social science courses relevant to the discipline. Alternatively, in place of ii), some student experience (e.g., annexed to capstone design) that require inputs from social sciences relevant to that experience may be required. |
| **WK2:** Conceptually-based **mathematics**, numerical and **data analysis**, statistics and formal aspects of computer and information science to support analysis and modelling applicable to the discipline | **SK2:** Conceptually-based **mathematics**, numerical and **data analysis**, statistics and aspects of computer and information science to support analysis and use of models applicable to the sub-discipline | **DK2:** Procedural **mathematics**, numerical analysis, statistics applicable in a sub-discipline | Curriculum may contain appropriate mathematics, data analysis, numerical analysis, and statistics/probability courses along with computation and information theory experiences using contemporary tools. |
| **WK3:** A systematic, theory-based formulation of **engineering fundamentals** required in the engineering discipline | **SK3:** A systematic, theory-based formulation of **engineering fundamentals** required in an accepted sub-discipline | **DK3:** A coherent procedural formulation of **engineering fundamentals** required in an accepted sub-discipline | Curriculum must contain basic engineering courses of the discipline, such as material science, fluid mechanics, heat transfer, dynamics, circuits, and so on |
| **WK4:** 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. | **SK4:** Engineering **specialist knowledge** that provides theoretical frameworks and bodies of knowledge for an accepted sub-discipline | **DK4:** Engineering **specialist knowledge** that provides the body of knowledge for an accepted sub-discipline | Curriculum must contain appropriate contemporary courses |
| **WK5:** Knowledge of efficient resource use, minimum waste and environmental impacts, whole-life cost, resource re-use, net zero carbon and the like that supports **engineering design** in a practice area. | **SK5:** Knowledge of efficient resource use, minimum waste, whole-life cost net zero carbon and the like that supports **engineering design** using the technologies of a practice area. | **DK5:** Knowledge of efficient resource use, minimum waste, whole-life cost net zero carbon and the like that supports **engineering design** based on the techniques and procedures of a practice  Area | Each design experience of the students need be taking the relevant considerations at the interface with other domains (science, law, art, humanities) into account and sustainability concepts including SDG12. Additionally, the curriculum may include specific teachings on the supporting factors of design |
| **WK6:** Knowledge of **engineering practice** (technology) in the practice areas in the engineering discipline | **SK6:** Knowledge of **engineering technologies** applicable in the sub-discipline | **DK6:** Codified **practical engineering knowledge** in recognised practice area. | The curriculum needs to transcend the theory and include teachings on the current technology and contemporary practice and thinking |
| **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 and benefits to advance the UN Sustainable Development Goals for economic, environmental and social benefits for all ~~cultural, environmental and sustainability~~ | **SK7: Comprehension of** the role of technology in society and identified issues in applying engineering technology: ~~ethics and~~ impacts~~: economic, social, environmental and sustainability~~ of the technology in the context of UN Sustainable Development Goals | **DK7: Knowledge** of issues and approaches in engineering technician practice: ~~ethics,~~ financial, cultural, environmental and sustainability impacts in the context of UN Sustainable Development Goals | All student experiences of the curriculum need to be realized within the context that engineering has a responsibility to society. Every major design activity in the curriculum requires an integrated approach that takes into account impacts on people, the environment, economic, social, cultural, resource and other impacts as articulated in the UN SDGs. |
| **WK8:** Engagement with selected knowledge in the **research literature** of the discipline, and, awareness of the power of critical thinking and creative approaches to incorporate broader emerging issues | **SK8:** Engagement with the **technological literature** of the discipline; awareness of the power of critical thinking |  | The curriculum needs to be up to date and reflect contemporary practices and approaches. The teachings should encourage the students to ask questions, to brainstorm and, to consider alternative solutions, and balance competing objectives |
| **WK9**: **Ethical attitude and behavior**; Awareness and ability to work in diverse teams by ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and inclusive attitudes. | **SK9**: **Ethical attitude and behavior**; Awareness and ability to work in diverse teams by ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and inclusive attitudes. | **DK9**: **Ethical attitude and behavior**; Awareness and ability to work in diverse teams by ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and inclusive attitudes. | The students need to learn how to work in diverse teams on a range of projects in such a way that the inclusive and ethical approach is embedded in work practices. |
| A programme that builds this type of knowledge and develops the attributes listed below is typically achieved in 4 to 5 years of study, depending on the level of students at entry. | A programme that builds this type of knowledge and develops the attributes listed below is typically achieved in 3 to 4 years of study, depending on the level of students at entry. | A programme that builds this type of knowledge and develops the attributes listed below is typically achieved in 2 to 3 years of study, depending on the level of students at entry. |  |

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| **Table 4 Graduate Attribute Profiles** | | | | | | | | | |
| References to the Knowledge Profile are shown thus: (WK1 to WK4) | | | | | | | | | |
| **Differentiating**  **Characteristic** | | **… for Washington Accord Graduate** | | **… for Sydney Accord Graduate** | | **… for Dublin Accord Graduate** |  | | |  |
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| **Engineering**  **Knowledge:** | | **WA1:** Apply knowledge of mathematics, natural science, computing and engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop the solution of complex engineering problems. | | **SA1:** Apply knowledge of mathematics, natural science, computing and engineering fundamentals and an engineering specialization as specified in SK1 to SK4 respectively to defined and applied engineering procedures, processes, systems or methodologies. | | **DA1:** Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization as specified in DK1 to DK4 respectively to wide practical procedures and practices. | ThiThe graduate is expected to also develop the necessary skills in addition to knowledge of mathematics, natural science and engineering fundamentals. | | |
| **Problem Analysis**  Complexity of analysis | | **WA2:** Identify, formulate, research ~~literature~~ and analyse *complex* engineeringproblems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences with holistic considerations for sustainable development. (WK1 to WK4) | | **SA2:** Identify, formulate, research ~~literature~~ and analyse *broadly-defined* engineering problems reaching substantiated conclusions using analytical tools appropriate to the discipline or area of specialisation. (SK1 to SK4) | | **DA2:** Identify and analyse*well-defined* engineering problems reaching substantiated conclusions using codified methods of analysis specific to their field of activity. (DK1 to DK4) |  | | |  |
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| **Design/ development of solutions:** Breadth and uniqueness of engineering problems i.e. the extent to which problems are original and to where solutions have not previously been identified or codified | | **WA3:** Design solutions for*complex*engineering problems and design systems, components or processes that meet identified ~~specified~~ needs with appropriate consideration for public health and safety, whole-life cost, net zero carbon, resource re-use, cultural, societal, and environmental considerations. (WK5) | | **SA3:** Design solutions for*broadly- defined* engineering technology problems and *contribute to* the design of systems, components or processes to meet identified ~~specified~~ needs with appropriate consideration for whole-life cost, net zero carbon, public health and safety, cultural, societal, and environmental considerations. (SK5) | | **DA3:** Design solutions for*well-defined*technical problems and *assist with* the design of systems, components or processes to meet identified ~~specified~~ needs with appropriate consideration for whole-life cost, net zero carbon, public health and safety, cultural, societal, and environmental considerations. (DK5) | ThiA graduate is expected to consider the whole of life cost and net zero carbon of solutions from cradle to cradle. | | |
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| I**nvestigation**: Breadth and depth of investigation and experimentation | | **WA4:** Conduct investigations of complex problems and systems using research-based knowledge (WK8) and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions | | **SA4:** Conduct investigations of broadly-defined problems; locate, search and select relevant data from codes, data bases and literature (SK8), design and conduct experiments to provide valid conclusions | | **DA4**: Conduct investigations of well-defined problems; locate and search relevant codes and catalogues, conduct standard tests and measurements. |  |  | |
| **~~Modern Digital~~ Tool Usage:** Level of understanding of the appropriateness of technologies and ~~various~~ tools | | **WA5:** Create, select and apply appropriate techniques, including prediction and modelling, computing and information tools, and data analytics ~~and modern engineering and IT tools~~, ~~including prediction and modelling~~, to *complex* engineering problems, with an understanding of the limitations. (WK6) | | **SA5:** Select and apply appropriate techniques, including prediction and modelling, as well as resources, including computing and information tools, ~~and modern engineering and IT tools,~~ ~~including prediction and modelling~~, to *broadly-defined* engineering problems, with an understanding of the limitations. (SK6) | | **DA5:** Apply appropriate techniques, resources, including computing and information tools, ~~and modern engineering and IT tools~~ to *well- defined* engineering problems, with an awareness of the limitations. (DK6) |  | The graduate is expected to use data, modelling and computational techniques to simulate possible solutions while understanding the implications of assumptions made and limitations of the data being used. | |
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| **The Engineer and Society:** Level of  knowledge and  responsibility | **WA6:** Apply reasoning within sound decision making frameworks that are informed by contextual knowledge and stakeholder consultation to assess societal, health, safety, legal, historical and cultural issues and the consequent responsibilities for sustainable development relevant to professional engineering practice and solutions to complex engineering problems. (WK7) | | **SA6:** Demonstrate understanding of the societal, health, safety, legal and cultural issues and the consequent responsibilities for sustainable development relevant to engineering technology practice and solutions to broadly defined engineering problems. (SK7) | | **DA6:** Demonstrate knowledge of the societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to engineering technician practice and solutions to well defined engineering problems. (DK7) | | The ability to consult with stakeholders from a wide cross-section of society and consider a range of requirements, has been added. | |  |
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| **Human, Social, Economic and Environmental impacts ~~and~~**  **~~Sustainability~~:** Type of  solutions. | **WA7:** Understand and evaluate the sustainability ~~and~~ impact of professional engineering work in the solution of complex engineering problems in human, cultural, economic, social ~~eta~~l and environmental contexts. (WK7) | | **SA7:** Understand and evaluate the sustainability ~~and~~ impact of engineering technology work in the solution of broadly defined engineering problems in human, cultural, economic, social ~~societa~~l and environmental contexts. (SK7) | | **DA7:** Understand and evaluate the sustainability ~~and~~ impact of engineering technician work in the solution of well-defined engineering problems in human, cultural, economic, social ~~societa~~l and environmental contexts. (DK7) | | The ability to evaluate the impact of engineering solutions on people, the economy and the environment has been added | |  |
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| **Ethics:** Understanding  and level of practice | **WA8:** Apply ethical principles and commit to professional ethics, technology ethics, data ethics, global responsibilities, ~~and responsibilities~~ and norms of engineering practice; and adhere to relevant national and international laws. Comprehend the need for diversity and inclusion (WK9) ~~(WK7)~~ | | **SA8:** Understand and commit to professional ethics, data ethics, and responsibilities and norms of engineering technology practice for compliance with national and international laws (SK9) ~~(SK7)~~ | | **DA8:** Understand and commit to professional ethics, data ethics, and responsibilities and norms of technician practice including compliance with relevant laws (DK9) ~~(DK7)~~ | | The importance of the responsible use of data in engineering solutions, ethical responsibilities for compliance with national and international law have been added. | |  |
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| **Individual and Collaborative Team work:** Role in and diversity of team | **WA9:** Function effectively as an individual, and as a member or leader in diverse and inclusive teams and in multi-disciplinary and long-distance settings. | | **SA9:** Function effectively as an individual, and as a member or leader in diverse and inclusive, multidisciplinary, and distributed teams. | | **DA9:** Function effectively as an individual, and as a member in diverse multidisciplinary and distributed technical teams. | | The importance of working effectively in diverse teams by ethnicity, gender, age, etc. has been added | |  |
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| **Communication:** Level of communication according to type of activities performed | **WA10:** Communicate effectively and inclusively on*complex* engineering activities with the engineering community and with society at large, such as being able to comprehend, write and present in a variety of ways effectively considering cultural, language and learning differences ~~reports and design documentation, make effective presentations, and give and receive clear instructions.~~ | | **SA10:** Communicate effectively and inclusively on*broadly- defined* engineering activities with the engineering community and with society at large, by being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language differences ~~and give and receive clear instructions~~ | | **DA10:** Communicate effectively and inclusively on*well-defined* engineering activities with the engineering community and with society at large, by being able to comprehend the work of others, document their own work, ~~and give and receive clear instructions~~ | | The importance of inclusive communication, written and verbal, taking account of cultural, language and other differences, has been added | |  |
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| **Project Management and Finance:** Level of management required for differing types of activity | **WA11:** 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, to manage projects and in multidisciplinary environments. | | **SA11:** Demonstrate knowledge and understanding of engineering management principles and apply these to one’s own work, as a member or leader in a team and to manage projects in multidisciplinary environments. | | **DA11:** Demonstrate knowledge and understanding of engineering management principles and apply these to one’s own work, as a member or leader in a technical team and to manage projects in multidisciplinary environments | |  | |  |
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| **Continual Lifelong learning:** Preparation for and depth of continuing learning. | **WA12:** Recognize the need for, and have the preparation and ability to engage in i) independent and life-long learning ii) creativity and adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8) | | **SA12:** Recognize the need for, and have the ability to engage in i) independent and life-long learning and ii) critical thinking in specialist technologies. (SK8) | | **DA12:** Recognize the need for, and have the ability to engage in independent updating in the context of specialized technical knowledge. | | The importance of creativity, critical thinking and lifelong learning, has been added | |  |
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**Table 5 Professional Competency Profiles**

To meet the minimum standard of competence a person must demonstrate the ability ~~he/she is able~~ to practice competently ~~in his/her~~  their practice area to the standard expected of a reasonable Professional Engineer/Engineering Technologist/Engineering Technician.

The extent to which the person is able to perform each of the following elements in their ~~his/her~~ practice area must be taken into account in assessing whether or not ~~he/she meets~~ the overall standard is met.

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| **Differentiating**  **Characteristic** | **Professional Engineer** | **Engineering Technologist** | **Engineering Technician** |  |
| **Comprehend and apply universal knowledge:** Breadth and depth of education and type of knowledge | **EC1:** Comprehend and apply advanced knowledge of the widely-applied principles underpinning good practice | **TC1:** Comprehend and apply the knowledge embodied in widely accepted and applied procedures, processes, systems or methodologies | **NC1:** Comprehend and apply knowledge embodied in standardised practices |  |
| **Comprehend and apply**  **local knowledge:** Type of local knowledge | **EC2:** Comprehend and apply advanced knowledge of the widely-applied principles underpinning good practice specific to the jurisdiction of ~~in which he/she~~ practice. | **TC2:** Comprehend and apply the knowledge embodied procedures, processes, systems or methodologies that is specific to the jurisdiction of ~~in which he/she~~  practices. | **NC2:** Comprehend and apply knowledge embodied in standardised practices specific to the jurisdiction ~~in which he/she~~ of practice.. | Gender neutral language used. |
| **Problem analysis:**  Complexity of analysis | **EC3:** Define, investigate and analyse complex problems using data and information technologies | **TC3:** Identify, clarify, and analyse broadly- defined problems using the support of computing and information technologies | **NC3:** Identify, state and analyse well-defined problems using the support of computing and information technologies | The use of computing and IT tools has been added. |
| **Design and**  **development of solutions:** Nature of the problem and uniqueness of the solution | **EC4:** Design or develop inclusive solutions to complex problems with stakeholder consultation | **TC4:** Design or develop inclusive solutions to broadly-defined problems | **NC4:** Design or develop inclusive solutions to well- defined problems | The importance of inclusive solutions and stakeholder consultation has been added**.** |
| **Evaluation:** Type of activity | **EC5:** Evaluate the outcomes and impacts of complex activities in the contexts of risk and social, environmental, economic and resource impacts | **TC4:** Evaluate the outcomes and impacts of broadly defined activities in the contexts of risk and social, environmental, economic and resource impacts | **NC5:** Evaluate the outcomes and impacts of well-defined activities | The importance of evaluation and risk assessment in broad contexts has been added |
| **Protection of society:** Types of activity and responsibility to consider advancement of the UN Sustainable Development Goals ~~public~~ | **EC6:** Recognise the reasonably foreseeable social, cultural and environmental effects of complex activities generally, and have regard to the need for sustainable outcomes that leave no one behind per the UN Sustainable Development Goals; global quality of life for humans and the environment. ~~ility~~; ~~recognise that the protection of society is the highest priority~~ | **TC6:** Recognise the reasonably foreseeable social, cultural and environmental effects of broadly-defined activities generally, and have regard to the need for sustainable outcomes that leave no one behind per the UN Sustainable Development Goals; global quality of life for humans and the environment. ~~sustainability; take responsibility in all these activities to avoid putting the public at risk~~. | **NC6:** Recognise the reasonably foreseeable social, cultural and environmental effects of well-defined activities generally, and have regard to the need for sustainable outcomes that leave no one behind per the UN Sustainable Development Goals; global quality of life for humans and the environment. ~~sustainability; use engineering technical expertise to prevent dangers to the public.~~ | The importance of consideration of the advancement of the UN Sustainable Development Goals where relevant has been added |
| **Legal, environment, cultural and regulatory:** No differentiation in this characteristic | **EC7:** Meet all legal and regulatory Requirements, protect public health and safety, environment and cultural heritage in the course of all ~~his or her~~ activities | **TC7:** Meet all legal and regulatory  requirements and protect public health and safety environment and cultural heritage in the course of all ~~his or he~~r activities | **NC7:** Meet all legal and regulatory requirements and protect public health and safety environment and cultural heritage in the course of all ~~his or her~~ activities | The importance of compliance with relevant laws and regulations including to protect the environment and cultural heritage and gender neutral language has been added |
| **Ethics, Diversity, and Inclusion:** ~~No differentiation in this characteristic~~ Types of activity and attitude | **EC8:** Conduct ~~his or her~~ all activities ethically and inclusively, respecting cultural, ethnic, religious and all other differences | **TC8:** Conduct ~~his or her~~ all activities ethically, in diverse teams and understand the need for inclusion | **NC8:** Conduct ~~his or her~~ all activities ethically, in diverse teams ~~Respect diversity~~ and understand the need for inclusion | The ethics of equal opportunity for all through working effectively in diverse and inclusive teams and gender neutral language has been added |
| **Manage engineering activities:** Types of activity | **EC9:** Manage part or all of one or more complex activities | **TC9:** Manage part or all of one or more broadly-defined activities | **NC9:** Manage part or all of one or more well-defined activities |  |
| **Communication and Collaboration:** Requirement for inclusive communications. No differentiation in this characteristic | **EC10:** Communicate and collaborate using multiple mediums clearly and inclusively with a broad range of stakeholders in the course of ~~his or her~~ all activities | **TC10:** Communicate and collaborate using multiple mediums clearly and inclusively with a broad range of stakeholders in the course of ~~his or her~~ all activities | **NC10:** Communicate and collaborate using multiple mediums clearly and inclusively with a broad range of stakeholders in the course of ~~his or her~~ all activities | The importance of inclusive communications and gender neutral language has been added |
| **Continuing Professional Development (CPD)**  **~~Lifelong learning:~~** Preparation for and depth of continuing learning. | **EC11:** Undertake CPD activities sufficient to maintain and extend technical competencies and enhance their ability to adapt to emerging technologies and the ever changing nature of work. ~~sufficient to maintain and extend his or her competencies~~ | **TC11:** Undertake CPD activities to adapt to emerging technologies and the ever changing nature of work ~~sufficient~~ to maintain and extend ~~his or her~~ competence | **NC11:** Undertake CPD activities to adapt to emerging technologies ~~sufficient~~ to maintain and extend ~~his or her~~ competence | The importance of lifelong learning in a world of rapidly changing technologies and gender neutral language has been added |
| **Judgement:** Level of developed knowledge, and ability and judgement in relation to type of activity | **EC12:** Recognize complexity and assess alternatives in light of competing social, economic, environmental, cultural and other requirements and considering incomplete knowledge. Exercise sound judgement in the course of all ~~his or her~~ complex activities | **TC12:** Choose appropriate technologies to deal with broadly defined problems considering social, economic, environmental, cultural as needed. Exercise sound judgement in the course of ~~his or her~~ broadly-defined activities | **NC12:** Choose and apply appropriate technical expertise. Exercise sound judgement in the course of ~~his or her~~ well- defined activities | The need to exercise judgement and application of knowledge and ability in broad context and gender neutral language has been added |
| **Responsibility for decisions:** Type of  activity for which responsibility is taken | **EC13:** Be responsible for making decisions on part or all of complex activities | **TC13:** Be responsible for making decisions on part or all of one or more broadly defined activities | **NC13:** Be responsible for making decisions on part or all of all of one or more well- defined activities |  |