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COMPLEX PROBLEM SOLVING - ENGINEERING COMPETENCE PROFILES

A professionally or occupationally competent person has the attributes necessary to perform the activities within the profession or occupation to the standards expected in independent employment or practice. The engineering competence (EC) profiles - complex engineering problems (CP) and complex engineering activities (CA) record the elements of competence necessary for performance that the professional is expected to be able to demonstrate in a holistic way the stage of attaining registration. Complex Engineering Problems have characteristic WK1 and some or all WK2 to WK9 as defined by National Board of Accreditation (NBA). Also, there are a Range of Complex Engineering Activities (CA) involved in when solving complex engineering problems.

Engineering competence can be described using a setoff attribute corresponding largely to the program outcomes (POs), but with different emphases. For example, at the professional level, the ability to the responsibility in the real-life situation is essential. Unlike the program outcomes, engineering competence is more than a set of attributes that can be demonstrated individually.

Competence must be assessed holistically TWELVE elements of engineering competences for a global benchmarking are mentioned in table 1.

Table 1: Engineering Competence Profiles

EC	Attributes	Descriptors for Rubric Design
EC 1	Depth of knowledge required	Ensures that all aspects of an engineering activity are soundly based on fundamental principles - by diagnosing, and taking appropriate action with data, calculations, results, proposals, processes, practices, and documented information that may be ill-founded, illogical, erroneous, unreliable or unrealistic requirements applicable to the engineering discipline
EC 2	Depth of analysis required	Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models.
EC 3	Design and development of solutions	Support sustainable development solutions by ensuring functional requirements, minimize environmental impact and optimize resource utilization throughout the life cycle, while balancing performance and cost effectiveness.
EC 4	Range of conflicting requirements	Competently addresses complex engineering problems which involve uncertainty, ambiguity, imprecise information and wide-ranging or conflicting technical, engineering and other issues.
EC 5	Infrequently encountered issues	Conceptualises alternative engineering approaches and evaluates potential outcomes against appropriate criteria to justify an optimal solution choice.
EC 6	Protection of society	Identifies, quantifies, mitigates and manages technical, health, environmental, safety, economic and other contextual risks

		associated to seek achievable sustainable outcomes with engineering application in the designated engineering discipline.
EC 7	Range of resources	Involve the coordination of diverse resources (and for this purpose, resources include people, money, equipment, materials, information and technologies) in the timely delivery of outcomes
EC 8	Extent of stakeholder involvement	Design and develop solution to complex engineering problem considering a very perspective and taking account of stakeholder views with widely varying needs.
EC 9	Extent of applicable Codes, Legal and Regulatory	Meet all level, legal, regulatory, relevant standards and codes of practice, protect public health and safety in the course of all engineering activities.
EC 10	Interdependence	High level problems including many component parts or sub-problems, partitions problems, processes or systems into manageable elements for the purposes of analysis, modelling or design and then re-combines to form a whole, with the integrity and performance of the overall system as the top consideration.
EC 11	Continuing Professional Development (CPD) and lifelong learning	Undertake CPD activities to maintain and extend competences and enhance the ability to adapt to emerging technologies and the ever-changing nature of work.
EC 12	Judgement	Recognize complexity and assess alternatives in light of competing requirements and incomplete knowledge. Require judgement in decision making in the course of all complex engineering activities.

The engineering competence profiles are stated generically and are applicable to all engineering disciplines. The application of a competence profile may require application in different regularly, disciplinary, occupational or environment contexts.