COMPETENCY STANDARDS

INSTITUTION OF INCORPORATED ENGINEERS, SRI LANKA

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PREFACE

***Institution of Incorporated Engineers Sri Lanka**, established in 1977 was incorporated by an Act of the Parliament of Democratic Socialist Republic of Sri Lanka.*

IIESL has a wide opening for personnel of all levels in the field of Engineering Technology. Thousands of its members are holding responsible positions in almost every development programs in the island and around the world.

This document describes the Competency Standards required for Corporate Member category of the institution memberships.

CONTENTS

PART A: GENERAL COMPETENCY REQUIRMENTS FOR CORPORATE MEMBERS

1 INCORPORATED ENGINEER

1.1 GENERAL ROLE OF AN INCRPORATED ENGINEER

*Incorporated Engineer*s normally operate within a relatively well-defined technical environment, and undertake a wide range of functions and responsibilities. They are often specialists in the theory and practice of a particular branch of engineering technology or engineering-related technology, and in its application, adaptation and management in a variety of contexts. Their expertise lies in familiarity with its current state of development and its most recent applications. Within their specialist field, their expertise may be at a high level, and fully equivalent to that of a chartered engineer and they are expected to exercise the same breadth of perspective as a chartered engineer, or carry the same wide-ranging responsibilities for stakeholder interactions, for system integration, and for synthesizing overall approaches to complex situations and complex engineering problems but with a different prospective.

The work of *Incorporated Engineer* combines the need for a strong grasp of practical situations and applications, with the intellectual challenge of keeping abreast of leading-edge developments in their particular field. For this purpose they need a strong understanding of scientific and engineering principles and a well developed capacity for analysis. The work of technologists is most often concerned with applying current and emerging technologies, often in new contexts; or with the application of established principles in the development of new practice. They may also contribute to the advancement of particular technologies.

Some *Incorporated Engineer* qualifications include an emphasis on technical management as well as grounding in a particular area of technology. Technical management is seen as an appropriate field of specialization in itself, and many technologists build their career paths in this direction. Examples of such specialization include product development for manufacturing, manufacturing management, mine management, and management and maintenance of processing plants, complex building services, or testing laboratories.

The competencies of *Incorporated Engineer* equip them to approve and certify many technical operations such as calibration and testing regimes, compliance with performance-based criteria for fire safety, and design of components and sub-systems and of installations such as building services in circumstances that do not call for significant new development. Such certification should be fully acceptable in the public domain and should not require further endorsement by other practitioners perceived to be more highly qualified.

Incorporated Engineer may lead or manage teams appropriate to these activities. Some may establish their own companies or may move into senior management roles in engineering and related enterprises, employing professional engineers and other specialists where appropriate.

1.2 COMPETENCIES

Qualifications for an *incorporated engineer* may relate to a particular technology or group of technologies such as Civil Engineering technologists, Electro mechanical engineering technologists, Quantity Surveying technologists, building management services technologists, telecommunications technologists etc that have application in many contexts. Alternatively, they may relate to the technologies supporting a particular industry sector, such as air-conditioning and refrigeration, aviation, the biomedical industry, manufacturing, railway signaling, transport services, building construction civil engineering construction, telecommunication, water and electricity service providers or hospitality industry. The term technology is used below in the singular, and should be understood to mean also a group of technologies supporting an industry sector.

Within their organization, an *incorporated engineer* may be the person most expert in a particular technology or area of application, with responsibility for its reliable operation. They will also recognize as persons who have chosen to specialize in technical management – such as management of a testing laboratory, building and construction management, and manufacturing management – provided they have an adequate grounding in the technologies concerned, as well as in the techniques of management.

This competency standard represents the level of preparation necessary and adequate for entry to practice leading to these responsibilities. An *associate member* would be expected to work initially under the supervision and guidance of more experienced incorporated engineers or chartered engineers, while experience is gained.

Associate *members* are encouraged to undertake IIESL approved Professional Development Programs while developing the practice competencies that will qualify them for a competency assessment and the status of Corporate Incorporated Engineer.

These competencies correspond to completion of a 3-year Engineering Diploma accredited by *Institution of Incorporated Engineers Sri Lanka* and 10 years of post qualifying experience. It is not expected that candidates will have demonstrated every detail of the knowledge, competencies and attributes that follow; but they must demonstrate at least the substance of each element. Assessment will be made in a holistic way.

1.3 UNITS AND ELEMENTS OF COMPETENCY

Units and elements of competency standards are presented in the following chapters Units are numbered IE1, IE2 etc. Elements are numbered IE1.1, IE 1.2 etc. Indicators are denoted by a, b, c etc. In is not anticipated that all competencies are to be met by a candidate. A holistic approach for assessment will be utilized in assessing the competency levels.

PART B: COMPETENCY STANDARDS FOR CORPORATE MEMBERSHIP

IE1 KNOWLEDGE BASE

IE1.1 KNOWLEDGE OF SCIENCE AND ENGINEERING FUNDAMENTALS

a. Sound knowledge of mathematics to the level required for fluency in the techniques of analysis and synthesis that are relevant to a branch of engineering technology and its major areas of application, and to related technologies.

b. Sound basic knowledge of the physical sciences, life sciences, and/or information sciences underpinning the technology and related technologies, and appreciation of scientific methods.

c. Strong grasp of the areas of engineering science that support the technology.

d. Ability to work from first principles in tackling technically challenging problems in the area of specialization.

e. Appreciation of the future need to apply fundamental knowledge to ongoing developments in the technology and to new technologies relevant to the area of application.

IE1.2 UNDERSTANDING OF THE TECHNOLOGY AND ITS APPLICATIONS

a. Knowledge of all aspects of an engineering technology and its major industrial, commercial and community applications; and/or of the technologies supporting a particular industry sector.

b. Competence in applying mathematics, science and engineering science to the analysis and solution of representative problems, situations and challenges in the technology and its utilization.

c. Knowledge of relevant materials and resources and their main properties, and ability to select appropriate materials, resources and techniques for particular applications.

d. Ability to recognize results, calculations or proposals that may be ill-founded, identify the source and nature of the problem and take corrective action.

e. Awareness of current technical and professional practice, critical issues, and the current state of developments in the technology and its major areas of application.

f. Understanding of how new developments in the technology or its areas of application relate to established theory and practice, and to other technical areas with which they may interact.

g. Advanced knowledge in at least one area of application of the technology, to a level that engages with current developments in that area.

h. Ability to ensure that applications and extensions of the technology are soundly based in theory and fundamental principles

i. Formal knowledge of the management of technical operations including business, financial, human resource, logistic, marketing, organizational, and procurement aspects, product and process development, and managed approaches to innovation.

IE1.3 TECHNIQUES AND RESOURCES

a. Familiarity with mathematical and physical modeling techniques relevant to the field of specialization; ability to utilize these techniques for purposes of analysis and design, and understanding of their applicability and limitations.

b. Ability to characterize materials, devices and systems relevant to the field of specialization.

c. Awareness of relevant current tools for analysis, simulation, synthesis and design, particularly computer-based tools and packages, and competence in their use.

d. Appreciation of the accuracy and limitations of such tools and the assumptions inherent in their use.

e. Proficiency in the range of laboratory and testing procedures relevant to the technology and strong grasp of principles and practices of laboratory safety.

f. Ability to design and conduct relevant experiments, devise appropriate measurements, analyze and interpret data and form reliable conclusions.

g. Ability to perceive possible sources of error, eliminate or compensate for them where possible, and quantify their significance to the conclusions drawn.

h. Ability to construct and test representative components or sub-systems in a laboratory setting.

IE1.4 GENERAL KNOWLEDGE

a. Educational background and/or general knowledge necessary to understand the place of engineering

IE2 ENGINEERING ABILITY

IE2.1 ABILITY TO UNDERTAKE PROBLEM IDENTIFICATION, FORMULATION, AND SOLUTION

a. Within the relevant field of specialization, ability to identify the nature of a technical problem, formulate an approach to its solution, make appropriate simplifying assumptions, and achieve a solution.

b. Ability to quantify the significance of the assumptions to the reliability of the solution and take further steps if necessary.

c. Ability to investigate a situation, or the behavior of a system, and identify any underlying causes relevant to the field of specialization.

d. Ability to recognize problems that have origins outside the area of specialization and communicate them to an appropriately competent person

IE2.2 ABILITY TO APPLY AND ADAPT THE TECHNOLOGY

a. Knowledge of the factors likely to be important in particular areas of application of the technology, and ability to understand and manage them

b. Ability to appreciate and manage the interactions between the technology and other parts of an overall technical system, define operating interfaces with other technologies, equipment or systems, and ensure that such interfaces function effectively.

c. Ability to adapt the technology to a variety of situations, understanding its properties, possibilities and limitations.

d. Ability to identify and solve effectively a wide variety of practical problems arising from application of the technology in different contexts

IE2.3 PROFICIENCY IN DESIGN OF EQUIPMENT OR INSTALLATIONS UTILIZING THE TECHNOLOGY

a. Ability to design equipment or installations utilizing the technology

b. Experience in personally conducting a significant design exercise to achieve an engineering outcome to professional standards, demonstrating capacity to:

- understand and document the required outcomes of a project or program utilizing the technology
- evaluate and confirm the appropriateness of the proposed use of the technology
- develop and complete the design using appropriate engineering principles, resources, processes, codes and standards
- specify the equipment and operating arrangements needed.
- quantify the engineering tasks needed to implement the design.
- devise and document tests to verify performance.
- if appropriate, produce technical manual for users of the equipment or installation.

c. Alternatively, experience as a member of a team conducting such a significant design exercise, and ability to demonstrate a key contribution to the team effort and the success of the outcome

d. Ability to ensure that all proposals and designs emphasize safety, reliability, maintainability, cost effectiveness, product quality and value, and user-friendliness

IE2.4 ABILITY TO CONDUCT AN ENGINEERING PROJECT

a. Experience in personally conducting and completing an engineering project appropriate to the field, to a high standard; or experience as a member of a team conducting and completing such a project, and ability to demonstrate a key contribution to the team effort and the success of the outcome.

A Stage 1 applicant should have undertaken and completed at least one construction project, one investigative project and one design project. At least one of these should be conducted, individually, and at least one as part of a team. Accredited qualification programs should provide and require such project work for all students.

b. Have produced at least one substantial report demonstrating mastery of the subject matter and ability to communicate complex material clearly.

IE2.5 ABILITY TO ENSURE RELIABLE OPERATION

a. Thorough understanding of standards and codes of practice relating to the technology and its applications.

b. Understanding of the concept and processes of inspection and testing of equipment or installations which utilize the technology, identification of shortcomings, and where appropriate certification of compliance with standards and codes and/or performance-based criteria.

c. Where the technology is itself a medium for measuring or testing materials, components, or quantities, ability to conduct such measurements or tests and accept responsibility for accuracy and validity.

d. Understanding of fundamental properties and limitations of the technology and ability to identify circumstances that suggest a significant problem.

IE2.6 RESPONSIBILITY AS TECHNICAL EXPERT

a. Ability to communicate the significance of the technology and its use in a particular context, to other technical and non-technical stakeholders in a project or program.

b. Ability to identify, assess, communicate and manage technical risk associated with use of the technology

c. Appreciate the interactions between technical systems and the social, cultural, environmental, economic and political context in which they operate; appreciate the imperative of sustainability, and approaches to developing and maintaining sustainable systems.

IE2.7 CAPACITY TO CONTRIBUTE TO ADVANCEMENT OF TECHNOLOGY

a. Appreciation of the evolving nature of technology and its applications

b. Capacity to contribute to the advancement of technology and its adaptation to new applications or situations

c. Readiness to apply fundamental knowledge to ongoing developments in technology, and to embrace new technologies relevant to the industry sector or field of application.

IE2.8 UNDERSTANDING OF THE BUSINESS ENVIRONMENT

a. Introductory knowledge of the conduct and management of engineering enterprises and of the structure and capabilities of the engineering workforce.

b. Appreciation of the commercial, financial and marketing aspects of engineering projects and programs and the requirements for successful innovation.

c. Ability to assess realistically the scope and dimensions of a project or task in the field of specialization, as a starting point for estimating costs and scale of effort required.

d. Understanding of the need to incorporate cost considerations throughout the design and execution of a project and to manage within realistic constraints of time and budget.

e. General awareness of business principles and appreciation of their significance.

IE3 PROFESSIONAL ATTRIBUTES

IE3.1 ABILITY TO COMMUNICATE EFFECTIVELY, WITH THE ENGINEERING TEAM AND WITH THE COMMUNITY AT LARGE

a. Fluency in written and spoken English

b. Ability to make effective oral and written presentations to technical and non-technical audiences

c. Capacity to hear and comprehend others' viewpoints as well as convey information

d. Effectiveness in discussion and in presenting arguments clearly and concisely

e. Ability to represent engineering issues and the engineering profession to the broader community

IE3.2 ABILITY TO MANAGE INFORMATION AND DOCUMENTATION

a. Ability to locate, analyze, catalogue and utilize relevant information, including proficiency in accessing, systematically searching, analyzing and evaluating relevant publications.

b. Ability to assess the accuracy, reliability, and authenticity of information relevant to the field.

c. Ability to produce clear diagrams and engineering sketches.

d. Fluency in current computer-based word-processing and graphics packages.

e. Ability to maintain a professional journal and records and to produce clear and well-constructed engineering documents such as progress reports, project reports, reports of investigations, proposals, designs, briefs, and technical directions.

f. Awareness of document identification and control procedures

IE3.3 CAPACITY FOR CREATIVITY AND INNOVATION

a. Readiness to challenge engineering and technological practices from a technical and non-technical viewpoint, to identify opportunities for improvement.

b. Ability to apply creative approaches to identify and develop alternative solutions.

c. Awareness of other fields of engineering and technology with which interfaces may develop, and openness to such interactions.

d. Propensity to seek information from widest practicable range of sources.

e. Readiness to engage in wide-ranging exchanges of ideas, and receptiveness to change.

IE3.4 UNDERSTANDING OF PROFESSIONAL AND ETHICAL RESPONSIBILITIES, AND COMMITMENT TO THEM

a. Familiarity with *Institution of Incorporated Engineers Sri Lanka's* Code of Ethics, and any other compatible codes of ethics relevant to the technology and its areas of application, and commitment to their tenets.

b. Awareness of legislation and statutory requirements relevant to the technology and its areas of application.

c. Familiarity with standards and codes of practice relevant to the technology and its areas of application.

IE3.5 ABILITY TO FUNCTION EFFECTIVELY AS AN INDIVIDUAL AND IN MULTIDISCIPLINARY AND MULTICULTURAL TEAMS WITH THE CAPACITY TO BE A TEAM LEADER OR MANAGER AS WELL AS AN EFFECTIVE TEAM MEMBER

a. Manage own time and processes effectively, prioritizing competing demands to achieve personal and team goals and objectives.

b. Earn trust and confidence of colleagues through competent and timely completion of tasks.

c. Communicate frequently and effectively with other team members.

d. Recognize the value of cultural diversity, develop effective intercultural skills, and build network relationships that value and sustain a team ethic.

e. Mentor others, and accept mentoring from others, in technical and team issues.

f. Demonstrate capacity for initiative and leadership while respecting others' agreed roles.

IE3.6 CAPACITY FOR LIFELONG LEARNING AND PROFESSIONAL DEVELOPMENT

a. Recognize limits to own knowledge and seek advice, or undertake research, to supplement knowledge and experience.

b. Take charge of own learning and development. Understand the need continually to review own strengths, determine areas for development and undertake appropriate learning programs.

c. Commit to the importance of being part of a professional community: learning from its knowledge and standards, and contributing to their maintenance and advancement

d. Improve non-engineering knowledge and skills to assist in achieving engineering outcomes.

IE3.7 PROFESSIONAL ATTITUDES

a. Present a professional image in all circumstances, including relationships with clients, suppliers and stakeholders as well as professional and technical colleagues.

b. Demonstrate intellectual rigor and readiness to tackle new issues in a responsible way.

c. Demonstrate a sense of the physical and intellectual dimensions of projects and programs, and related information requirements, based on reasoning from first principles.