

GUIDANCE NOTES FOR ENGINEERING ACADEMICS SEEKING PROFESSIONAL MEMBERSHIP AND/OR CHARTERED PROFESSIONAL ENGINEER REGISTRATION

This document provides guidance for Engineering Academics on the evidence to submit for a competence assessment against the competence standard for *Initial Registration as a Chartered Professional Engineer (CPEng)* and *Professional Membership (MIPENZ)*.

WHAT IS A COMPETENCE STANDARD?

A competence standard is an indication of an expected level of performance. The competence assessments conducted by IPENZ require applicants to provide sufficient evidence to demonstrate they are able to consistently apply knowledge, understanding and skills to the standard expected of a reasonable professional engineer.

CPENG AND MIPENZ QUALITY MARKS

CPEng and MIPENZ are two quality marks with different meanings and this has implications in terms of the nature of evidence and the assessment process that is applied.

CPEng is a quality mark of current competence as a practising engineer (e.g. providing engineering services to clients) and this means that a key consideration is the currency of evidence submitted for assessment. Assessors give greatest consideration to evidence relating to an applicant's engineering activities over the last 5 years.

As the Registration Authority under the CPEng Act, IPENZ also assumes regulatory responsibilities when considering applications for CPEng, and is required to ensure that specific process requirements set out in the CPEng Rules are applied in each case.

MIPENZ is a quality mark of professional standing that does not necessarily provide an assurance of current competence to practice. The standard of competence required at initial assessment is the same as for CPEng but the evidence that may be considered need not be limited to the most recent 5 years. Professional Members of IPENZ have demonstrated a capability to practice competently as a professional engineer (i.e. to the same standard as a CPEng) at some stage in their career. This means that the assessment process can give more weight to less current evidence of competence, including, for example Round One PBRF evidence portfolios (or similar), or work from earlier industry based roles.

MIPENZ does not have the same requirement for demonstration of current competence as CPEng. As a result, less recent evidence may be acceptable for an MIPENZ application, demonstrating competence, at some stage, against the standard.

An area of particular difficulty for academics can be providing evidence that they meet the requirements relating to managing and taking responsibility for complex engineering activities (particularly for academics who do not currently have significant programme leadership responsibilities or who are not involved in managing external research projects). Evidence from previous roles, perhaps in industry, can then be presented.

When considering applications for MIPENZ, the assessment panel is also able to consider more “indirect” evidence of competence. Examples of this could include evidence of peer esteem from industry, or evidence of strong positive relationships with industry, being taken as indirect evidence of a capability to manage and take responsibility for complex engineering activities.

Some engineering academics, particularly those who teach engineering design and project courses, are active in consultancy work, or engaged in standard setting or expert witness activities, are expected to seek CPEng registration to provide recognition of their current competence and direct involvement in industry practice. However, a greater number of academics are likely to seek Professional Membership (MIPENZ) as recognition of their standing in and engagement with the profession in its broadest interpretation.

Academics may gain Professional Membership (MIPENZ) without any further assessment through the ‘credit schedule’ process if they are already members of a recognised professional body. The details of how the credit schedule operates are on the IPENZ website at http://www.ipenz.org.nz/ipenz/join/Credit_For_Registrants.cfm. Otherwise the portfolio of evidence will need to be the same as that outlined below.

DOCUMENTATION REQUIRED

Engineering Academics applying for competence assessment are required to submit documentation in line with CPEng Rules and/or IPENZ Regulations (refer <http://www.ipenz.org.nz/ipenz/join/ipenz.cfm>). These guidelines are intended to provide some assistance for academics in compiling that documentation.

Considering the Rules and Regulations, an appropriate portfolio of evidence from an engineering academic would be:

- An Application for Admission Form (CA01), including the names of two referees (who are required to complete Referee Declarations (Form CA06))
- A Competence Self Review (Form CA03) referencing evidence provided in the portfolio that addresses each competence element
- A full Academic CV outlining career progression and significant engineering activities and including such information as:
 - positions held both in industry and tertiary institutions
 - key publications
 - grants gained
 - theses/research projects supervised
 - courses taught
 - key research areas
 - administration/service duties performed

- consulting/standard setting/expert witness activities.

Note: submission of a full academic CV as outlined above would remove the need to provide separate summaries of work history (Form CA04) and continuing professional development (Form CA05)

- Verified copies of academic qualifications gained.

Additional Information that we recommend is provided in support of an application includes:

- A covering letter of verification and support from Dean or HOD (who may also act as a referee by submitting a Referees Declaration (Form CA06))
- A copy of latest PBRF evidence portfolio (in full or part) and/or information on the outcome of the latest PBRF assessment
- A selected number of work samples, which may include 1-2 recent refereed journal or conference papers. Internal reports may be appropriate to evidence management and decision making competencies.

APPLICATION EVALUATION PROCESS

The general process for evaluating an application is set out in the Competence Assessment Reference Guide at:

www.ipenz.org.nz/ipenz/Forms/pdfs/CARG_Competence_assessment_Reference_Guide.pdf

Engineering academics applying for MIPENZ only as their initial assessment may not be required to undergo a full interactive interview as described in the Guidelines where they:

- Hold a Masters or PhD qualification in engineering

And

- Hold appointment as a senior lecturer or above; or,
- Provide evidence of having gained a PBRF grade of B or better.

FORMAT OF COMPETENCE STANDARD FOR PROFESSIONAL ENGINEERS

The “Competence Standard for Professional Engineers” consists of the following:

12 elements: these represent broad areas of professional engineering performance. Taken holistically these elements make up the minimum standard for registration as outlined in the CPEng Rules.

performance indicators (bullet points): these provide further detail as to the meaning of each element thereby enabling the applicant and assessors to have a clearer understanding of the performance required to demonstrate competency in each element. They are important indicators of competence but are not absolute criteria that must all be met nor are they an exhaustive list.

definitions: these provide a critical component of the standard and need to be considered carefully by applicants when they are preparing their portfolio of evidence to demonstrate they meet the competency standard.

- **Note on “Performance assessed against each Element”**

Those undertaking an initial competence assessment with IPENZ are expected to provide to their Assessment Panel evidence of their current competence which demonstrates that they are able to meet all the *elements* of the standard. The Panel, however, considers the totality of the evidence supplied and makes an *holistic* assessment as to whether each applicant meets the CPEng or MIPENZ competency standard.

COMPETENCE STANDARD FOR PROFESSIONAL ENGINEERS

Professional Engineering - Element 1

Element description

1 Comprehend, and apply knowledge of, accepted principles underpinning widely applied good practice for professional engineering

Performance Indicators

- Has a Washington Accord degree or recognised equivalent qualification or has demonstrated equivalent knowledge and is able to:
 - Identify, comprehend and apply appropriate engineering knowledge
 - Work from first principles to make reliable predictions of outcomes
 - Seek advice, where necessary, to supplement own knowledge and experience
 - Read literature, comprehend, evaluate and apply new knowledge

General Guidelines

- This element is intended to show the candidate currently has the level of knowledge of a Washington Accord degree – as evidenced by an accredited Washington Accord degree (or recognised equivalent qualification) supported by on-going CPD, although applicants can demonstrate they have acquired the same level of knowledge through other learning processes
- Applicants are able to apply that knowledge through work experience. The competence required by the standard is that of a 4-year Washington Accord degree graduate with typically 4 to 5 years post-graduation work experience
- Qualifications other than Washington Accord equivalent may require knowledge assessment
- Applicants will be expected to show their ability to work from first principles and to comprehend and apply engineering knowledge – and evidence of this skill will be critical for non-Washington Accord qualified applicants in meeting this element of the standard

Additional Guidelines for Engineering Academics

- Engineering academics should present their engineering qualifications as evidence of meeting this criterion

Professional Engineering - Element 2

Element description

2 Comprehend, and apply knowledge of, accepted principles underpinning good practice for professional engineering that is specific to the jurisdiction in which he/she practices (For CPEng assessment this relates to the jurisdiction of NZ)

Performance Indicators

- Demonstrates an awareness of legal requirements and regulatory issues within the jurisdictions in which he/she practices
- Demonstrates an awareness of and applies appropriately the special engineering requirements operating within the jurisdictions in which he/she practices

General Guidelines

- Evidence that shows the applicant understands and works in compliance with the relevant regulatory framework - for example, compliance regimes covered by statute or local body by-law, mandatory standards or codes of practice
- Demonstrate an understanding of situations and responsibilities when/where standards/guidelines/specifications need to be modified or amended to suit specific situations and document the resulting implications

Additional Guidelines for Engineering Academics

Engineering academics might highlight the following evidence as part of their self review:

- Teaching into IPENZ- accredited BE programmes (provides evidence of relevance to NZ engineering context)
- Examples of teaching informed by current NZ practice
- Involvement in standards development
- Examples of NZ consultancy work
- Providing technical seminars for industry

Professional Engineering - Element 3

Element description

3 Define, investigate and analyse *complex engineering problems* in accordance with good practice for professional engineering

Performance Indicators

- Identifies and defines the scope of the problem
- Investigates and analyses relevant information using quantitative and qualitative techniques
- Tests analysis for correctness of results
- Conducts any necessary research and reaches substantiated conclusions

General Guidelines

- Demonstrate knowledge of technical fundamentals (including initial specification and brief in terms of client perceptions, use of engineering design standards and specifications) to scope a complex engineering problem
- Examples of methodologies used for analysis, prediction and choice outside those encompassed by standard codes (including preparing functional design requirements, addressing design concepts, and determining possible design constraints)
- Evidence of experiments conducted, prototypes built or simulations performed to test analyses
- Evidence of literature searches, use of network of peers to gather information on approaches to problem solving

Additional Guidelines for Engineering Academics

Engineering academics might highlight the following evidence as part of their self review:

- Research and consultancy work
- Thesis supervision and/or examination
- Teaching and supervision of design classes or research projects

Professional Engineering - Element 4

Element description

4 Design or develop solutions to *complex engineering problems* in accordance with good practice for professional engineering

Performance Indicators

- Identifies needs, requirements, constraints and performance criteria
- Develops concepts and recommendations that were tested against engineering principles
- Consults with stakeholders
- Evaluates options and selects solution that best matched needs, requirements and criteria
- Plans and implements effective, efficient and practical systems or solutions
- Evaluates outcomes

General Guidelines

- Evidence of personal responsibility taken in a project or significant task from the end of an investigation phase, showing design solutions developed which resulted in all objectives being met. To indicate the level of complexity, describe involvement in detail. This can be over a range of similar projects/tasks or one overall project/task with multiple components

Additional Guidelines for Engineering Academics

Engineering academics might highlight the following evidence as part of their self review:

- Research and consultancy work
- Thesis supervision and/or supervision
- Teaching and supervision of design classes or research projects

Professional Engineering - Element 5

Element description

5 Be responsible for making decisions on part or all of one or more *complex engineering activities*

Performance Indicators

- Takes accountability for his/her outputs and for those for whom he/she is responsible
- Accepts responsibility for his/her engineering activities

General Guidelines

- Demonstrate effective self-management skills (including: undertaking professional development, setting own goals, practising effective time management, and recording professional development activities)
- Undertake and accept responsibility for higher levels of engineering activity, such as preparing and presenting submissions, estimates, project funding requests, annual planning activities and reports to client and senior management. Be responsible for and conduct public and stakeholder consultation and meetings

Additional Guidelines for Engineering Academics

Engineering academics might highlight the following evidence as part of their self review:

- Research and consultancy work
- Academic leadership and/or curriculum development responsibilities
- Providing technical seminars for industry
- Involvement in standards development
- Acting as an expert witness

Professional Engineering - Element 6

Element description

6. Manage part or all of one or more *complex engineering activities* in accordance with good engineering management practice

Performance Indicators

- Plans, schedules and organises projects to deliver specified outcomes
- Applies appropriate quality assurance techniques
- Manages resources, including personnel, finance and physical resources
- Manages conflicting demands and expectations

General Guidelines

- Project Management responsibility for a group of smaller projects and engineering activities or a significant part of a larger project
- Undertake site management activities such as the Engineer/Client/ or Contractor's Project Manager (work at higher level than Element 5)

Additional Guidelines for Engineering Academics

Engineering academics might highlight the following evidence as part of their self review:

- Academic leadership and/or curriculum development responsibilities that require management of external engagement with industry
- Bidding for and managing external research contracts
- Involvement in standards development
- Acting as an expert witness

Professional Engineering - Element 7

Element description

7 Identify, assess and manage engineering risk

Performance Indicators

- Identifies risks
- Develops risk management policies, procedures and protocols to manage safety and hazards
- Manages risks through 'elimination, minimisation and avoidance' techniques

General Guidelines

- Evidence of training in risk management
- Knowledge of (not necessarily the use of) specialist software used for risk management
- Consider risks within alternative designs/timings/solutions/options

Additional Guidelines for Engineering Academics

Engineering academics might highlight the following evidence as part of their self review:

- Supervision of safety in laboratory classes and practical work
- Examples of integrating risk management strategies into teaching materials
- Examples from consultancy work

Professional Engineering - Element 8

Element description

8 Conduct engineering activities to an ethical standard at least equivalent to the relevant code of ethical conduct

Performance Indicators

- Demonstrates understanding of IPENZ and/or CPEng codes of ethics
- Behaves in accordance with the relevant code of ethics even in difficult circumstances (includes demonstrating an awareness of limits of capability; acting with integrity and honesty and demonstrating self management)

General Guidelines

- Evidence of exercising judgement on own competence – outline actions taken when confronted with work outside own area of competence
- Evidence of managing conflicts of interest – description of actions taken to resolve
- Evidence of quality assurance procedures and risk management methodologies used in professional engineering practise

Additional Guidelines for Engineering Academics

Engineering academics might highlight the following evidence as part of their self review:

- Evidence of understanding of ethical issues as they relate to an academic context – consultancy, research and publication
- Examples of integration of Ethics into teaching materials

Professional Engineering - Element 9

Element description

9 Recognise the reasonably foreseeable social, cultural and environmental effects of professional engineering activities generally

Performance Indicators

- Considers and, where needed, takes into account health and safety compliance issues and impact(s) on those affected by engineering activities
- Considers and takes into account possible social, cultural and environmental impacts and consults where appropriate
- Considers Treaty of Waitangi implications and consults accordingly
- Recognises impact and long-term effects of engineering activities on the environment
- Recognises foreseeable effects and where practicable seeks to reduce adverse effects

General Guidelines

- Evidence of addressing needs of key stakeholders (Iwi, historic places, archaeology, etc - consultation, and possibility for alternative design to reflect needs and aspiration of those affected)
- Evidence of life-cycle considerations in engineering designs – wastage, build ability, materials used, energy consumption and maintenance requirements during operational life, end-of-life issues (disposal and demolition)
- Identify the need for sustainable solutions to engineering and construction activities
- Evidence of actions taken to address health and safety and environmental implications of projects during and after construction/implementation

Additional Guidelines for Engineering Academics

Engineering academics might highlight the following evidence as part of their self review:

- Examples from research and consultancy work
- Related teaching responsibilities

Professional Engineering - Element 10

Element description

10 Communicate clearly with other engineers and others that he or she is likely to deal with in the course of his or her professional engineering activities

Performance Indicators

- Uses oral and written communication to meet the needs and expectations of his/her audience
- Communicates using a range of media suitable to the audience and context
- Treats people with respect
- Develops empathy and uses active listening skills when communicating with others
- Operates effectively as a team member

General Guidelines

- Effective communicate in the English or other language (sign, Maori etc) language - orally and in writing
- Preparing, interpreting and presenting information, issuing clear and accurate instructions, interpreting instructions, and selecting appropriate methods of communication – for variety of audiences (one-to-one and one-to-many communications; technical and non-technical personnel etc)
- Evidence of acceptance by peers by attendance and active participation in meetings, work place activities, training courses etc where candidate presents points-of-view and debates the topic or issue
- Evidence of leadership - of self and others

Additional Guidelines for Engineering Academics

Engineering academics might highlight the following evidence as part of their self review:

- Teaching practice (including student feedback)
- Examples of publications/reports
- Thesis supervision

Professional Engineering - Element 11

Element description

11 Maintain the currency of his or her professional engineering knowledge and skills

Performance Indicators

- Demonstrates a commitment to extending and developing knowledge and skills
- Participates in education, training, mentoring or other programmes contributing to his/her professional development
- Adapts and updates knowledge base in the course of professional practice
- Demonstrates collaborative involvement with professional engineers (NZ engineers for CPEng assessments)

General Guidelines

- Maintains Continued Professional Development (CPD) records
- Identifies future needs and plans competence development accordingly
- Actively participates with professional bodies
- Participates in diverse engineering activities leading to learning and betterment of engineering skills by a combination of training internal to organisation and external CPD, and self directed learning
- Maintains a network of professional engineers – peer reviews, collaborative activities
- Evidence of reflecting and learning from mistakes with the benefit of hindsight

Additional Guidelines for Engineering Academics

Engineering academics might highlight the following evidence as part of their self review:

- Examples of research led teaching or development/review of courses/papers
- Study leave activities
- Examples from research and consultancy work

Professional Engineering - Element 12

Element description

12 Exercise sound professional engineering judgement

Performance Indicators

- Demonstrates the ability to identify alternative options
- Demonstrates the ability to choose between options and justify decisions
- Peers recognise his/her ability to exercise sound professional engineering judgement

General Guidelines

- Undertake complex and multi-criteria analysis as a part of exercising engineering judgement
- Takes a holistic approach in the development and implementation of engineering solutions, respecting other professional and individual inputs and demonstrating a balanced process to achieve desired outcomes.
- Undertakes decision making - uses technical, economic, social, environmental etc criteria when where there is a choice of options (e.g., what factors were taken into account in making the decision? What impact did those factors have? What were the benefits/compromises in making the decision?)
- Feedback and learning from one's peers (e.g. positive peer review of work)

Additional Guidelines for Engineering Academics

Engineering academics might highlight the following evidence as part of their self review:

- Examples from research and consultancy work evidenced by examples from PBRF portfolio
- Peer esteem (such as evidenced by PBRF portfolio)

DEFINITIONS:

I PRACTICE AREA

The **practice area** of an engineer is defined by both the area in which the engineer holds specialised engineering knowledge and the nature of the activities performed. Both of these may change over the course of professional life. The competence of the applicant will be assessed in his/her current area of engineering practice.

In an Academic context this is likely to be stated as:

Teaching, research, consultancy, academic leadership (delete as appropriate) in the area of [insert]

II COMPLEX ENGINEERING ACTIVITIES

Complex engineering activities means engineering activities or projects that have some or all of the following characteristics:

Involve the use of diverse resources (and, for this purpose, **resources** include people, money, equipment, materials and technologies);

Require resolution of critical problems arising from interactions between wide-ranging technical, engineering and other issues;

Have significant consequences in a range of contexts;

Involve the use of new materials, techniques, or processes or the use of existing materials, techniques, or processes in innovative ways.

In an academic context this is most likely to be evidenced by managing activities that involve interface between industry and academia. Examples of this would include:

- *Applied research or consultancy work (particularly multidisciplinary activity)*
- *Academic leadership and/or curriculum development responsibilities involving engagement with industry*
- *Providing technical seminars for industry*
- *Involvement in engineering standards development*
- *Acting as an expert witness*

III COMPLEX ENGINEERING PROBLEMS

Complex engineering problems have some or all of the following characteristics:

- Involve wide-ranging or conflicting technical, engineering, and other issues;
- Have no obvious solution and require originality in analysis;
- Involve infrequently encountered issues;

- Are outside problems encompassed by standards and codes of practice for professional engineering;
- Involve diverse groups of stakeholders with widely varying needs;
- Have significant consequences in a range of contexts;
- Cannot be resolved without in-depth engineering knowledge.

IV KNOWLEDGE SPECIFIC TO LOCAL JURISDICTIONS

Candidates will need to provide evidence that, within the jurisdictions in which they work, they:

- Understand the general principles behind applicable codes of practice;
- Have demonstrated a capacity to ensure such principles are applied safely and efficiently; and
- Are aware of the special requirements operating within the host jurisdiction.

V METHODS OF ANALYSIS

The techniques used in quantitative analysis will vary depending on the area of engineering practice however they include computer, mathematical or reliability modelling, statistics, and the use of planning tools.

VI DESIGN AND DEVELOPMENT

Design and development are a conceptual processes used to bring together innovation, aesthetics and functionality to plan and create an artefact, product, process, component or system to solve a complex engineering problem. The design or development process may develop the shape, size and selection of material and components for engineering products/outcomes.

Design and development also include engineering planning, an example of which is the process of locating facilities and items of engineering construction taking into account all the factors affecting their relationship and their inter-relationships with the external environment.

VII RESPONSIBILITY FOR MAKING DECISIONS FOR COMPLEX ENGINEERING ACTIVITIES

Applicants may be taken to have been **responsible for making decisions for complex engineering activities** when they have:

- Planned, designed, co-ordinated and executed a small project; or
- Undertaken part of a larger project based on an understanding of the whole project;
- Or undertaken novel, complex or multi-disciplinary work.