Competence Profiles – Guidance for applicants and Assessors

PART 2 – INDUSTRY CLASSIFICATION (I) – COMPUTERS IN ENGINEERING & IT

Introduction

It has long been accepted that the computer has produced a revolution in the practice and scope of mechanical engineering. Whilst the basic requirements of qualification, training, experience and responsibility must still be met, there is a need to take a broader view of those requirements in the light of Computer Aided Design (CAD) and Computer Aided Engineering (CAE). In the context of CAE, it is important to draw a distinction between those engineers who are simply users of computer systems, including new forms of software, and those who work in the computer industry in its broadest sense. In the case of the user, the question of whether or not he or she is qualified for Corporate Membership is not directly related to the use made of computers. Virtually all chartered engineers will use computers to a greater or lesser extent and the case of any applicant must continue to be based on the level of engineering knowledge, experience, judgement and responsibility exercised.

Requirements for election or transfer to Member

Within the Computer Industry there are three classes of particular interest:

1. Analyst/programmers with little engineering background. They may be engaged in the development of a system specified by an engineering user but requiring no particular engineering knowledge for this purpose. Their skills may lie in the areas of mathematics or computer science or some relatively non-technological area.

2. Those with orthodox engineering qualifications who, after a period of training and, possibly, engineering responsibility, have moved into the area of computer systems. They may bridge the gap between supplier and user and may use their engineering knowledge helping to specify a system, as well as in analysing and programming it.

3. Those who may, or may not, have a first degree in engineering and have then taken a post in the computer systems industry without undergoing any formal engineering training, though some may have taken a higher degree through research. They may then develop a high level of expertise in particular areas such as risk analysis, stress analysis, or heat transfer. Through the application of this knowledge to a variety of engineering projects they may establish themselves as specialist consultants in a field of activity relevant to any one (or more) of the technical Divisions of the Institution.

From the point of suitability for Corporate Membership it is felt that those in class (1) would normally be unsuccessful but a high proportion of those in class (2) would be expected to succeed. Applicants in class (3) would require some measure of flexibility in the assessment of qualifications, training criteria and competences.

Assessment of Competences

Professional mechanical engineering responsibilities for the types of work described above will, of course, depend to a large extent on the particular company and location, the type of equipment being manufactured or utilised and the individual's job description. This reinforces the importance of carefully assessing applicants' personal responsibilities and competences, together with their direct input to projects in their work area and their degree of supervision. In addition, clear and comprehensive organisation charts will be key to the appraisal process. **It will no longer be appropriate to recommend election to Member on the basis of job title or grade.**

The following pointers may be useful to interviewers and applicants in determining eligibility for Corporate Membership.

- In general, the applicant must provide evidence of the ability and requirement to apply professional engineering judgement based on a thorough initial engineering formation. Assessors should look carefully at how competence and judgement have been developed in the post-formation period.

- The applicant should have a sound basis of practical experience in industry or a research environment, and must demonstrate an understanding of the physical science aspects of the current job rather than being an applied mathematician.

- Engineers engaged in writing software may be acceptable, provided they have the engineering knowledge to develop the shell environment. Configuration of software in accordance with a user's instructions would not normally be the work of a professional engineer.

In the case of applicants engaged in the creation of computer models to simulate and analyse problems, they should be able to demonstrate the ability to carry out manual as well as computational analysis. In particular they should demonstrate:

1. the ability to carry out manual analysis beforehand in order to define the procedure for the task;

2. that he or she is defining the "intelligence" to be processed – i.e. defining the question rather than simply processing it. This could include determining the engineering requirements of potential customers;

3. that independent verification is carried out by a competent third party – the applicant should also perform this verification rôle for others doing similar work;

4. the ability to correlate computational findings to test data.

<u>Competence statements A and B</u>

Successful applicants will be able to demonstrate their use of a combination of general and specialist engineering knowledge and understanding to optimise the application of existing and emerging technology in their chosen field within the computer industry, be it in design, manufacture, operations, maintenance, operating or applications software development, engineering services or any of the other appropriate areas outlined above.

Applicants engaged primarily in project engineering or management should provide, and assessors should seek, evidence of responsibility for technical specifications, technical risk management, evaluation of technical solutions and monitoring against technical performance standards.

Examples of situations or activities that may give mechanical engineers the opportunity to achieve and demonstrate professional competence in these areas include:

- Development of solid modelling tools
- Engineering Database Management (EDM), Process Review and Business Process Re-engineering (BPR)
- Dynamic analysis
- Data acquisition
- Development of standards

- Development of Finite Element (FE) and cutting edge Computational Fluid Dynamics (CFD) code
- Embedded microprocessor systems design e.g. Engine Management systems
- Design of Collaborative Working Technology tools enabling 'shared' processes e.g design
- Internet-enabled monitoring systems e.g. remote alarm monitoring and diagnostics
- Systems integration process design at the factory organisational level

Activities that are unlikely to be at professional level include the extraction of data from 3D CAD models, using procedures defined by others, and investigation of the stress analysis interface following models provided by others. Control theory is a grey area that must be explored carefully; mechanical control theory should be an acceptable mechanical engineering discipline, whereas electrical control theory may be more appropriate to the Institution of Electrical Engineers.

Competence statement C

As many companies now operate a matrix management structure, applicants are not necessarily expected to have line management responsibility or experience in order to meet the required level of competence in this section. Also, engineers who have moved into highly specialist technical rôles, e.g. in company headquarters engineering departments and in equipment manufacturing companies, may have minimal management responsibilities; such applicants would be expected to have a high degree of autonomy in planning and monitoring their activities and care should be taken to explore the interface between them and their colleagues and supervisors.

Examples of situations or activities that may give engineers the opportunity to achieve and demonstrate competence in these areas include:

- Active participation in post-FMEA design reviews and time-to-market milestone reviews of product mechanical design.
- The identification of training requirements for team members, to enhance their relevant skills; and the implementation of such training.
- Day-to-day review of those components of quality management systems relevant to the applicant's own field of work.

Competence statement D

Communication and interpersonal skills should be assessed by consideration of both the Professional Review Report and interview performance. Assessors should look out for a report which has a logical structure, clearly aimed at providing a portfolio of evidence against each of the five competence statements, while providing a qualitative description of activities and achievements.

Assessment of verbal communication skills should analyse the ability to give clear, concise and relevant answers that address the question without undue digression and provide sufficient, but not superfluous detail.

Additional evidence of competence in this area may be sought by investigating:

- Whether the applicant routinely makes presentations to technical and non-technical in-house staff at various levels, outside clients and contractors; subjects could include project plans, business plans, etc.
- Whether the applicant is involved in commercial and technical negotiations with component suppliers, contractors, etc.
- Any involvement in representational duties, e.g. staff councils, safety committees, staff appraisal, etc.

Competence statement E

The establishment and observance of safe working procedures, including compliance with internal, national and international codes of practice, is inherent in virtually all engineering activities in the computer industry. Similarly, there are codes that cover the design and manufacture of equipment and software; applicants should be able to show their commitment to observing and promoting the use of any such codes that are relevant. In particular, they should be able to demonstrate familiarity with such regulations as the Data Protection Act; the European Electronic Signature Directive (January 2001); the European Directive 96/9/EC (March 1996) on the Legal Protection of Databases; and the directive on Programmable Electronic Systems in Safety-Related Applications, published by the Health and Safety Executive.

Evidence of professional integrity and commitment should include a Self-Development Action Plan, in any convenient format, outlining how the applicant intends to maintain and enhance competence through personal development. The Plan should include short, medium and long-term goals and explain how these are likely to be achieved. Assessors should be aware that SARTOR 3 interprets Continuing Professional Development (CPD) as commencing at the point where Chartered status is attained; therefore applicants are not required to provide a record of courses attended, etc., when applying for corporate membership.

Examples of CPD activities recognised by the Institution as acceptable include:

- extra qualifications such as an MBA, Diploma in Engineering Management
- any relevant technical or business courses
- conducting or attending workshops
- attending, presenting or participating in seminars and conferences
- presenting or attending lectures
- writing technical papers
- reading technical articles and journals
- distance or open learning
- secondments and job rotation
- hosting visits from schools, colleges, etc.
- updating in own and other fields of work
- Institution meetings or events
- active IMechE committee work
- learning a foreign language
- involvement in government activities
- community and charity work

Requirements for election or transfer to Fellow

The following senior engineering posts within a company should be considered as generally likely to meet the requirements for the class of Fellow:

Director

Product Manager

Group Leader with 5 or more years' seniority

Applicants will generally have significant responsibilities for resources (both financial and manpower) and also have wide understanding of strategic, commercial and financial issues. They are likely to be experts in their particular fields, e.g. project management, radio-frequency technology or operating software, and "champions" for their directorate, company or industry sector.

Valid applications for election or transfer to Fellow may be received from other engineers with established reputations in important positions of responsibility in engineering science or practice. This applies to engineers both in manufacturing companies and with service providers. In addition to demonstration of achievements and standing in their field of engineering science or practice, applicants would be expected to participate in external forums, for example by promoting the importance of engineering issues in debate with Government and other bodies, via the Institution. In

any case, an involvement in the professional development of young engineers would be expected, as would documentary evidence of Continuing Professional Development.

Further examples of suitable CPD activities not covered under the requirement for Competence Statement E above include:

- MPDS mentoring
- Acting as an IMechE Membership Panel interviewer

For candidates applying directly for the class of Fellow, a Professional Review Report similar to that required for the class of Member would be required in addition to an interview. In particular, this report must contain additional supporting evidence detailing:

- The position of senior engineering responsibility held by the applicant
- The applicant's contribution to the professional development of young engineers
- How the applicant intends to keep up to date regarding developing technologies, from both a technical and a commercial standpoint.

Finally, a Development Action Plan detailing a future programme of CPD would be required from applicants in either category (transfer from Member or direct election).