ENGINEERS AUSTRALIA

ACCREDITATION BOARD

ACCREDITATION MANAGEMENT SYSTEM

FOR

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0	Associate Director – Accreditation. Professor Alan Bradley.	Chair of the Accreditation Board. Professor Robin King.	1 February, 2011

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1. INTRODUCTION

Engineers Australia, as the national competency authority responsible for the accreditation of engineering education programs in Australia, provides a range of documents within its Accreditation Management System. These documents provide a resource for both engineering educators and those responsible for the accreditation function. An index of the documents comprising the Accreditation Management System is provided in Reference 7,

'Engineers Australia – Accreditation Management System – Document Listing' for curriculum based programs in the occupational category of Engineering Associate.

This guideline document has been prepared as a supplement to Reference 1 which summarises the criteria for accreditation. The accreditation criteria provide the basis for evaluation of engineering education programs and also provide, for engineering educators, a resource for the review and development of the teaching and learning environment, for the educational design and review tasks and for the processes of continuous quality improvement.

This accreditation guide is for educational institutions seeking Engineers Australia accreditation of a program at Australian Qualifications Framework (AQF) level 6 and in the Occupational Category of Engineering Associate.

In this document each element of the performance criteria is discussed in turn, to develop a more complete understanding of the overall performance expectations and compliance requirements within the Engineers Australia's Accreditation Management System.

The accreditation criteria are catalogued under the following section headings and the subsequent discussion is in accordance with this structure:

- The Operating Environment,
- The Academic Program,
- Quality Systems.

2. INTERPRETATION OF REQUIREMENTS

In this discussion of the criteria an attempt has been made to distinguish absolute requirements for accreditation from expected characteristics and performance levels and advice. Again the emphasis is on encouraging innovation and diversity in the educational design, delivery and quality processes. Statements variously employ the words **must** and **should**. Statements containing **must** denote absolute requirements for the program to be accredited. Statements containing **should** are not individually binding but for accreditation to be granted, it is expected that the program will meet a high proportion of them.

3. GUIDELINES TO THE CRITERIA

3.1. The Operating Environment

3.1.1. Organisational Structure and Commitment to Engineering Education

There must be an identifiable organisational entity responsible for engineering education within the educational institution awarding the qualification. The substantive organisational entity must have clearly designated and devolved accountability for the leadership, management and delivery of engineering education programs.

In this document and other documents comprising the Accreditation Management System, the term ***engineering school*** has been used as the universal term for the substantial organisational entity accountable for engineering learning.

It should be noted that other organisational structures may be acceptable but it is unlikely, for example, that an engineering program would be accredited if it were taught and managed in isolation by a handful of staff, primarily qualified and practising in a non-engineering discipline.

It would normally be expected that the engineering school would have leadership responsibility – subject to the approval processes of the host educational organisation – for the educational design, delivery, support and management of the engineering programs, for the management of associated resources, and for the appointment and professional activity of staff. If this is not the case, the educational institution will need to demonstrate how sufficient engineering expertise is brought to bear on decisions in these areas.

The delegated accountability within the engineering school for the management and delivery of each engineering education program should be clearly specified.

There must be evidence that the host educational institution regards engineering education as a significant and long-term component of its core activity, and has adequate arrangements for planning, development, delivery, and continuous quality improvement of engineering education programs, and for supporting the associated professional activities of staff. This would most commonly be evident from an institution's mission statement and strategic plans, from the approved mission statement and strategic plans of the engineering school, perhaps from corporate responses to engineering school planning submissions or initiatives, and from the outcomes of formal reviews and performance evaluations.

The host organisation must have in place adequate policies and mechanisms for funding its engineering school and facilitating the generation of funds from external sources. Similarly there must be established policy and appropriate practices for attracting, appointing, retaining and rewarding well-qualified staff and providing for their ongoing professional development, and for providing and updating infrastructure and support services. The host institution must ensure that creative leadership is available to the engineering school through the appointment of highly-qualified and experienced senior staff in sufficient numbers.

The educational institution must have in place formally constituted governance structures for the ongoing review and continuous quality improvement of existing programs and for formal approval of new programs and for program amendments.

The formally constituted governance structures should be supported by policies, procedures and processes for new program approval, development, implementation, registration, review and audit compliance which demonstrates the commitment of the educational institution to continuous quality improvement.

3.1.2. Academic and Support Staff Profile

The teaching staff must be sufficient in number and capability to assure the quality of the engineering program and the attainment of its stated outcomes. As a guide, <u>a viable engineering school offering bachelors degrees and associate degrees in engineering would be expected to have a minimum of eight full-time-equivalent</u>

academic staff employed on a continuing basis, with reasonable gender balance, and would be expected to have not less than three full-time-equivalent staff with specialist engineering knowledge and experience in any field in which a designated degree or major is offered. Where a program has little or no overlap with other programs offered, more than three specialist staff members are likely to be necessary.

In no case should a major program be dependent on a single individual.

There should be an acceptable balance of staff appointments across the A - E Academic levels (or other appointment designations) in order to provide appropriate academic leadership and at the same time an experience profile, breadth of expertise and student support appropriate to the program.

It is considered important that staff members should come from a diversity of backgrounds, embodying a mix of academic experience and engineering-practice experience in non-academic environments, preferably international as well as Australian. The school's research and/or professional activities should include vigorous interaction with industry and also community interaction.

In gauging the capabilities of staff, the Board will look at qualifications (both in engineering and in education), research and engineering practice activities, teaching experience, and contributions to the advancement of engineering knowledge, practice and education. Involvement in professional bodies; chartered status and/or registration and effective participation in on-going professional development are also relevant indicators.

Staff development programs should aim at strengthening capabilities in educational design, the use of new delivery methodologies, the development of learning management and quality assurance systems as well as professional standing within the specific engineering discipline.

As well as the full-time academic staff team, engineering schools are strongly encouraged to tap the expertise of practising professionals in engineering and related fields for guest lecturing or sessional delivery. There must also be sufficient qualified and experienced members of technical and administrative staff to provide adequate support to the educational program. There must be adequate arrangements for the supervision and guidance of both regular and sessional staff.

There should be appropriate policies and practices in place to satisfactorily manage staff workloads. The Board will look for evidence that staff numbers and teaching loads are such as to permit adequate interaction with learners and support for the range of learning experiences offered, with adequate opportunity available to staff for professional engagement outside of teaching. Arrangements for workload management, capacity and succession planning should support these objectives.

The engineering school and/or the educational institution must adequately provide for student counselling, support services, and interaction with relevant constituencies such as employers and graduates.

It is recognised that programs will increasingly be staffed and delivered in a variety of modes. Students will be supported to undertake learning activities at locations other than the 'host' campus through workplace and cooperative learning programs, distance delivery and through offshore arrangements. Educational institutions will form partnerships with both traditional and non-traditional providers to facilitate the delivery of engineering education. The educational institution/s awarding the degree will be considered responsible for assuring the capabilities of all staff involved, and the Board will require evidence of how this is achieved.

Academic staff must be aware of the need to address gender, cross-cultural, inclusiveness and equity issues. Staff development programs should reflect this need.

3.1.3. Academic Leadership and Educational Culture

For each program there should be a clearly identified and effective leader of a cohesive teaching team. Terms of reference, accountabilities and reporting obligations for the program teaching team and leader should be clearly defined and understood by all stakeholders.

The Board will look for evidence of a dynamic, innovative and outward-looking intellectual climate in the engineering school. In particular there should be awareness amongst teaching staff of current educational thinking and development. There should be a pro-active attitude to the adoption of best practice.

There should be significant, ongoing involvement of teaching staff in the processes of setting educational outcome targets, detailed educational design, review and continuous quality improvement. A holistic approach requires for a particular program the full involvement of all teaching staff as a program teaching team and this should be evident to students.

The program teaching team would be expected to meet regularly to consider input and feedback from the full range of constituencies, and use this in the on-going improvement of detailed learning strategies, structure, curriculum content and delivery. The teaching team should monitor, using declared performance criteria, the attainment of the targeted educational outcomes for the program as a whole as well as the delivery of the learning outcomes within individual modules of learning (courses, academic study units or subjects – herein referred to as academic units).

Staff should actively role-model the competencies defined in the appropriate Stage 1 - National Generic Competency Standard and should be continually aware of their responsibility to do so.

Staff appointment, staff development, management and codes of practice in the school and the institution should address cultural, gender and equity issues and reflect an inclusive operating environment.

Through policy and operating practices there should be clear acknowledgment of the need to interlink research, industry and community interaction with teaching to enrich the experiences of students and facilitate the on-going professional development of staff.

3.1.4. Facilities and Physical Resources

For both on-campus and external students alike there must be adequate classrooms, learning-support facilities, study areas, library and information resources, computing and information-technology systems, and general infrastructure to fully support the achievement of the targeted learning outcomes for each specific program.

For all programs and associated implementation pathways, there must be adequate facilities for student-staff interaction. For distance, remote campus or offshore implementations there must be communication facilities sufficient to provide students with learning experiences and support equivalent to on-campus attendance.

Appropriate experimental facilities must be available for students to gain substantial experience in understanding and operating engineering equipment, of designing and conducting experiments and undertaking engineering project work. The equipment must be reasonably representative of modern engineering practice and facilitate sound learning design. Facilities need to support structured laboratory activities, experiments of an investigatory nature and more open ended project based learning. Access to modern analysis, synthesis, visualisation, simulation, and planning, organisational and measuring tools in the engineering, sciences, business, and communication and management domains is expected.

Where practical work is undertaken remote from the host campus, such as at another educational institution or in an industry environment, the arrangements must be such as to provide appropriate facilities, supervision and equipment access and an assured equivalence of learning outcomes.

Facilities and equipment access must be supportive of the development of the full range of educational outcomes defined for a specific program and allow students to explore beyond the formal dictates of the particular discipline of study where appropriate.

Learning support services should be available both to students and to academic staff, to facilitate curriculum development, delivery and assessment of the full range of educational outcomes, and to match the learning needs of individual students. Such support may be provided via a combination of university-wide and locally-provided units and dedicated staff.

3.1.5. Funding

The funds provided through the host organisation, from all sources including government grant funds, fee income, and direct income earned through research and entrepreneurial activity, must be sufficient to adequately support the current engineering education programs and satisfy the resource aspects of the accreditation criteria. The strategic planning cycle and funding distribution models must ensure predicable levels of support and the on-going viability of the engineering school's programs. The funding model for any particular program implementation should be founded on sound business planning and strategic projections.

3.1.6. Strategic Management of the Student Profile

Resources provided to the engineering school are usually dependent on enrolled-student numbers. A criterion for viability is therefore a continuing level of demand for admission from adequately-qualified candidates in sufficient numbers to maintain the program. On-going viability should be monitored through rigorous demand analysis. Strategic decisions on program offerings should be taken systematically and on an appropriate time scale.

The admission system must adequately publicise the qualifications required for entry and ensure that only qualified candidates are admitted. Where advanced standing is offered, there must be clearly defined and rigorous processes for the analysis, assessment and verification of prior learning. The engineering school should be able to demonstrate a reasonable relationship between admission standards and student retention and graduation rates.

Determination of Honours/Distinction or any other specific achievement recognition must be based on a sound performance analysis rationale and reflect a standard of excellence commensurate with the performance criteria embedded within the educational outcomes specification and external benchmarks.

3.2. The Academic Program

3.2.1. Specification of Educational Outcomes

To ensure that a systematic approach is taken for the balanced development of graduates, each program submitted for accreditation must be supported by a published specification of educational outcomes tailored to the particular field(s) of practice and associated area(s) of specialisation. The educational outcomes specification should justify the inclusion or omission of any specialist title. External stakeholder input is critical to the development, review and attainment monitoring of these outcomes.

The Engineers Australia National Generic Competency Standards – Stage 1 Competency Standard for Engineering Associate (Reference 4) provides a detailed generic description of the expected knowledge, capabilities and attributes expected of the graduate Engineering Associate. The Competency Standard builds on and assures delivery of the original and brief generic attributes statement specified in the Accreditation Policy.

The Competency Standard develops detailed elements of competency and indication of performance under the headings of Knowledge Base, Engineering Ability and Professional Attributes. It provides an ideal, generic template or model for building a detailed educational outcome specification, customised for a particular education program in a nominated field of engineering practice.

The educational outcomes specification should include a statement of broad educational objectives as well as targeted graduate capabilities for the program in the specified field. The rationale for the specification of outcomes should be founded on the needs of industry and the community, trends in engineering practice and benchmark comparisons with programs of similar nature available nationally or internationally.

The statement of educational objectives should relate to the mission of the host institution and reflect the specialist technical focus, the anticipated career destinations of graduates, and the needs of appropriate external constituencies.

The educational objectives statement would also be expected to reflect the desired characteristics and/or capabilities and/or achievements of mature graduates within the first few years of their career following graduation.

The targeted capabilities for emerging graduates should be consistent with the generic Stage 1 – Competency Standard. Technical skills and knowledge and engineering application skills appropriate to the designated field of practice and/or specialisations should be clearly specified, supplementing the generic capabilities and attributes that are relevant to all fields of practice.

Targeted graduate capabilities should demonstrate a balanced and integrated development of enabling skills and knowledge, technical competence and engineering application skills, as well as personal and professional capabilities. Appropriate breadth and depth of competence must be clearly demonstrated in the technical domains comprising the field of practice and through high level knowledge and skills in nominated specialist areas.

Each graduate capability target should ideally include measurable performance indicators to provide a basis for monitoring the level of attainment. The multi-dimensional performance metric in each case is likely to involve quantitative and qualitative measures with inputs from a range of sources. Such measures would draw considerably on formal assessment processes from within academic units as well as from the feedback and direct input of various constituencies.

The specification of educational outcomes should provide a platform for subsequent educational design and review tasks and provide a key reference for tracking the aggregation of learning outcomes and assessment measures from individual academic units comprising the program.

3.2.2. Titles of Program and Award

To be eligible for accreditation, an engineering education program must include the word engineering and/or technology in its title and, unless the circumstances are exceptional, must lead to a qualification which includes *engineering and/or technology* in its title.

A program in the Engineering Associate category must aim to deliver graduates with capabilities appropriate to a designated field of engineering practice, program content and specialist focus. This will most commonly be reflected in the title of the program and/or the qualification or be cited as a major field of engineering practice on the award. Curriculum based Engineering Associate education programs will generally lead to qualifications of either Associate Degree or Advanced Diploma and will be consistent with the Australian Qualifications Framework requirements for these qualification categories within the Higher Education sector.

The key requirement is that the program engages students with an identifiable and coherent area of engineering application, providing an appreciation of current and emerging technical issues and the development of competence in handling well defined technical/operational problems.

Where a title denotes specialisation in a particular field of practice, the program must impart well defined technical/operational skills and knowledge in that specialisation. A program that omits coverage of substantial topics in the field implied by the title, in which a practitioner in that field could reasonably be expected to have competence, should not be accredited.

New program titles may be expected to arise in response to evolving industry practice (for example, as set out in the listings of engineering disciplines published from time to time by Engineers Australia and elsewhere). Programs may draw on several existing fields of specialisation, and may incorporate new knowledge or the application of knowledge in new practice environments. The Board does not wish to be prescriptive about titles, nor does it wish to encourage a proliferation of specialist titles that may have transitory lifetimes. It reserves the right to query a title or field of practice which it regards as inappropriate, or to decline to accredit.

Some of the fields of practice and specialisations already recognised in the titles of accredited Engineering Associate programs are listed in Reference 3.

3.2.3. Program Structure and Implementation Framework

The normal requirement of an accredited Engineering Associate program in Australia is two years of full-time-equivalent study, based on entry from a satisfactory level of achievement at Higher School Certificate level (twelve years of primary and secondary schooling) or equivalent. Programs offered via alternative implementation pathways (elective units and study sequences, workplace learning options, defined articulation routes, part-time attendance, distance mode, offshore and remote campus) must be demonstrably equivalent in terms of content, in the delivery of graduate outcomes as well as in the learning expectations of students.

The conventional academic year involves two semesters of formal study and examination, offering apparent scope for accelerated-progression utilising the remainder of the calendar year. In considering any program that offers completion in significantly less than two years, the Board will wish to be assured that it provides adequate opportunity for personal and professional skills development and the full equivalence of delivered outcomes.

Program durations exceeding the normal two years of full time study may be appropriate in some circumstances. Assessment will always be based on the assumed delivery of an appropriate standard of graduate outcomes, commensurate with the generic frame work of the Stage 1 Competency Standard and appropriate to the designated field of practice.

The curriculum must comprise an integrated set of tasks and structured learning experiences that lead to the delivery of the specified educational outcomes, and by implication, satisfactory attainment of the generic attributes. The necessary opportunities and support mechanisms must be provided.

The program structure must be appropriate to the development of in depth technical competence in the designated field of practice and in nominated specialist areas.

In accordance with the Accreditation Policy, a two-year Engineering Associate program would be expected to include the following elements, the percentages denoting indicative proportions of the total learning experience measured in terms of student effort:

1. Underpinning knowledge of mathematics, physical sciences, information systems and engineering fundamentals appropriate to the discipline of learning. (30%)
2. Application of the above to the solution of well defined problems and to the practice of engineering and technology including: the use of standards and codes of practice; specifying and installing systems; design procedures; assessment of technical and policy options; observation, analysis and testing; operations and maintenance and the assessment of risk across a broad operational context. (30%)
3. Specialisation within an engineering discipline. (15%)
4. Professional development including: the effective communication skills; the ability to operate as an individual or provide leadership in a team based environment; the use and management of information systems and an understanding of the business environment. (15%)
5. Application of principles, responsibilities and the ethics of engineering practice as well as an awareness of the professional obligations associated with occupational health and safety and environmental sustainability. (10%)

The above proportions are not mutually exclusive. Some relate principally to content, and others relate more to learning processes. A particular learning activity may consist of several of these component elements. Likewise a particular learning activity may concurrently contribute to various educational outcomes ranging through personal/professional, problem solving/design, enabling and specialist technical categories.

Substantial departure from these elemental proportions must be justified as consistent with the targeted educational outcomes for the program and thus the attainment of the Stage 1 competencies.

The structure should be sufficiently flexible to provide for any variance in the background and prior learning of students as well as for the differences in individual learning ability. The program structure must accommodate the curriculum requirements specified in section 3.2.4 below and should facilitate an integrated approach to:

- developing enabling skills and knowledge,
- developing in depth knowledge and understanding of a nominated field of technology and its applications,
- providing practical and laboratory learning, problem solving design and project based learning,
- developing personal and professional capabilities,
- exposing students to engineering practice.

The structure should also promote a graded transition of learning experiences from a structured beginning to a more independent learning approach as the program progresses.

A holistic approach to educational design will ensure that the individual learning outcomes and performance measures within each academic unit aggregate systematically to deliverer the educational outcomes targeted for the overall program.

3.2.3.1. Alternative Implementation Pathways

Flexible delivery options are usually implemented as alternative implementation pathways within a single program definition. Such pathways can range from alternative academic units selected from a list of electives for a student studying on the home campus, major and minor elective sequences, project options, workplace learning options, distance modes and various articulation routes right through to an offshore implementation of the program.

The program structure must accommodate such alternative pathways in such a way as to assure the equivalence of educational outcomes for every individual student. Reference 6 discusses in further detail the accreditation of alternative implementation pathways.

The early stages of the program should be tailored to the backgrounds of commencing students and should provide appropriate pathways for each group admitted. This should include special support programs for students admitted from disadvantaged or unconventional backgrounds, or with language difficulties.

3.2.4. Curriculum

The educational design and review process should be directed at an integrated curriculum delivering a balance of enabling or underpinning knowledge and skills, technical competence, engineering application skills and personal and professional capabilities.

The Engineers Australia National Generic Competency Standards - Stage 1 – Competency Standard for Engineering Associate (Reference 4) summarises the necessary outcomes, together with supporting elements, associated performance and range indicators in three categories as follows:

Knowledge Base which includes the following.

- Knowledge of science and engineering fundamentals.
- Knowledge and understanding of engineering and technology.
- Knowledge and application of engineering techniques and resources.
- General knowledge supporting the nominated field(s) of engineering practice.

Engineering Ability which includes the following.

- Application of standards and codes of practice.
- Specifying and installing systems.
- Understanding of design procedures.
- Assessing technical and policy options.
- Observation, analysis and testing.
- Specific training for:
    1. candidates whose background has included advanced equipment specific training, or
    2. candidates from a mainly educational background.
- Responsibility as a technical expert.
- Understanding of the business environment

Professional Attributes which include the following.

- Ability to communicate effectively with the engineering team and with the broader community.
- Ability to manage information and documentation.
- Capacity for creativity and innovation.
- Understanding and commitment to professional and ethical responsibilities.
- Ability to operate effectively as an individual or as a member of a multidisciplinary and multicultural team.
- Ability to operate effectively as a team leader or as a manager in a diverse team based environment.
- Capacity for and commitment to life long learning and continuing professional development.
- Demonstration of professional attitudes.

An integrated and pervasive approach to educational design must focus on delivery of the academic units prescribed for the designated program. The academic units will be delivered through a wide range of learning and assessment activities spread throughout all stages of the program. The learning and assessment design must rigorously confirm delivery of the graduate outcomes specification for the program as a whole, by mapping aggregation of the contributing learning outcomes and assessment activities set out for each academic unit against the targeted graduate capabilities.

Where the targeted graduate capabilities are compliant with the Engineers Australia Stage 1 Competency Standard, then attainment of the generic competencies and elements of competency that comprise the Standard will be assured through the learning and assessment design and mapping processes.

3.2.5. Exposure to Engineering Practice

Exposure to engineering practice is a key element in the successful completion of an Engineering Associate qualification. Although the status of Chartered Engineering Associate requires a substantial period of experiential formation in industry during and after graduation, it is clearly unsatisfactory for the student's perceptions of engineering to develop, over the program study years, in complete isolation from the realities of practice. There is obvious benefit in ensuring that at least an element of professional formation is interwoven with the academic program, to provide a balanced perspective and relate academic preparation to career expectations.

Engineering practice exposure must be considered as an integral learning activity within the educational design process and make a significant and deliberate contribution to the delivery of educational outcomes. The objectives associated with each major episode of exposure need to be clearly understood by all stakeholders and documented as a formal learning activity within a designated academic unit or units. There must be defined contributions from these activities to the specific learning outcomes of academic units and in turn to the educational outcomes of the program as a whole.

There should be a formalised tracking, monitoring and assessment of the learning outcomes associated with engineering practice exposure. This may for example be through a journal or portfolio system where students record and reflect on their experiences against the targeted graduate capabilities set for the program.

Engineering practice exposure must include some of the following:

- use of staff with industry experience,
- practical experience in an engineering environment outside the teaching establishment,
- mandatory exposure to lectures on professional ethics and conduct,
- use of guest presenters,
- industry visits and inspections,
- an industry based final year project,
- industry research for feasibility studies,
- study of industry policies, processes, practices and benchmarks,
- interviewing engineering practitioners,
- industry based investigatory assignments,
- direct industry input of data and advice to problem solving, projects and evaluation tasks,
- electronic links with practising Professional Engineers, Engineering Technologists and Engineering Associates/Officers, and
- case studies.

It is considered that there is no real substitute for first-hand experience in an engineering-practice environment, outside the educational institution. Engineers Australia strongly advocates that all engineering schools include a minimum of 6 weeks of such experience (or a satisfactory alternative) as a requirement for the granting of the qualification, in addition to the other elements suggested, and make strenuous effort to assist all students to gain placements of suitable quality. However it is recognised that this may not always be possible.

The requirement for accreditation is that programs incorporate a mix of the above elements, and others – perhaps offering a variety of opportunities to different students – to a total that can reasonably be seen as equivalent to at least 6 weeks of full time exposure to engineering practice in terms of the learning outcomes provided. In the same way as for other modes of learning, submitted documentation must explain how the various dimensions of engineering practice exposure contribute to the overall educational design.

Where practice exposure is incorporated as a formal component of the two-year equivalent curriculum, with designated academic credit, it must embody assessable requirements comparable with other curriculum elements that attract similar credit. Where a period of work experience in industry is required, but is not assessed as a direct component of academic credit, it should be counted in addition to the two year academic requirement.

3.3. Quality Systems

Appropriate policy, processes and practices must be in place at all levels within the educational institution to assure the quality of engineering education. The dimensions of the educational quality system must embrace the following components.

3.3.1. Formal processes for new program approval, development and amendment

The educational provider must have in place formal processes for approval, registration, development and amendment of any new program.

The formal processes should incorporate:

- key stakeholder input, demand analysis which establishes the rationale for the specific program;
- business planning to demonstrate economic viability and provision of adequate teaching resources;
- development of formal program objectives and targeted graduate capabilities compliant with the generic framework of the Stage 1 Competency Standard and the technical knowledge and skill appropriate to the field of practice; as well as
- learning and assessment design mapped against delivery of the graduate outcomes specification.

3.3.2. External Stakeholder Input to Continuous Improvement Processes

Valid preparation of students for engineering practice requires proactive and productive interaction with key external stakeholders and especially industry on a continuing basis. There have been many messages from industry, often at the highest levels, indicating that educational institutions have insufficient appreciation of the real needs of employment and must learn the real-world lessons of being customer driven, the importance of continuous quality improvement and the need for continuous interaction with a broad range of external stakeholders.

Furthermore if Australia is to have a globally competitive economy, then it must have a globally competitive education and training system which is responsive to the needs of its key stakeholders. Accordingly, all education providers must work collaboratively with industry as is a key stakeholder in the process. Since the early 1990's engineering schools have been making a concerted effort to response to these imperatives, and the Accreditation Policy requires that they continue to do so. For the response to be meaningful and effective, industry must make a serious commitment to the partnership in return. In this regard some companies have been exemplary, however many more examples are needed for the joint partnership to realise its full potential.

A specific requirement of the Engineers Australia Accreditation Policy is a formally-constituted advisory mechanism or mechanisms, involving program oriented external stakeholders generally and industry in particular. The formally-constituted advisory mechanism or mechanisms referred to as the program industry advisory body, would be expected to include a governance structure, charter and terms of reference, a summary of member roles and responsibilities, induction training and a schedule for the frequency of the meetings of the above body.

Through the program industry advisory body, the engineering school must seek to secure the active participation of practising Professional Engineers/Engineering Technologists/Engineering Associates, graduates, professional bodies and representatives of leading employers of engineering graduates as well as students in the specification, review and attainment monitoring of the graduate outcomes specification and in defining, updating and evaluating the educational design of the academic program.

In addition, the involvement of industry stakeholders will provide an important opportunity for students to gain access to structured work placements and exposure to current and emerging engineering practice.

Effective and productive industry linkages and engagement are also crucial for facilitating the necessary range of exposure to engineering practice as well as providing opportunity for collaborative project work and also for the professional development of staff.

3.3.3. Student Input to Continuous Improvement Processes

There must be formal processes for securing specific and systematic feedback from students. There should be evidence of the systematic application of feedback in conjunction with other quantitative measures for the setting, monitoring and review of the delivery of the academic units for the specific program.

Direct involvement of the students in the processes of continuous quality improvement is strongly encouraged. This can be achieved by the use of staff-student consultation forums, focus groups, use of survey instruments and commissioned submissions which should be integrated to facilitate productive involvement as well as providing direct learning experiences for the student in the processes of continuous quality improvement.

Students should be seen as partners in a culture of continuous quality improvement.

3.3.4. Processes for Setting and Reviewing the Educational Outcomes Specification

There should be formal, documented processes for setting and reviewing the detailed educational objectives and graduate capability targets for each program as a whole. Reviews should be regular and on-going. These processes should ensure that the outcomes specification remains aligned with the Engineers Australia Stage Generic Competency Standards – Stage 1 Competency Standard for Engineering Associate – (Reference 4), as well as external practices and specific industry needs. The specification of targeted graduate capabilities should cover enabling skills and knowledge, depth and breadth of technical competence, engineering application skills, as well as personal and professional capabilities. The Stage 1 Competency Standard provides a useful generic template for such an outcomes specification to which would need to be added technical outcomes appropriate to the designated field of practice and/or specialisation(s).

Systematic review processes should be inclusive of all staff engaged in the delivery of the program, and involve the on-going input of external constituencies as well as feedback and input from the student body.

3.3.5. Approach to Educational Design and Review

A systematic and holistic approach to educational design, review and continuous quality improvement must be evident.

Beginning with the specification of educational objectives and targeted graduate capabilities, a structured, 'top-down' approach to learning design should next determine the specific and measurable learning outcomes for each academic unit within the program.

At the academic unit level, the learning design process should continue by developing the appropriate learning activities and the formative and summative assessment approaches which monitor and measure the delivery of the learning outcomes. Closing the loop on learning outcomes, learning activities and assessment measures at the academic unit level should be a prime objective.

A mapping of the learning outcomes from individual academic units to the targeted graduate capabilities for the program as a whole should be a prime reference tool emerging from this process and underpin the outcomes based educational design. Subsequently, tracking this aggregation of learning outcomes and assessment measures from individual academic units to close the loop on delivery of graduate capabilities at the program level is a key component of the on-going review and improvement process.

Again, the educational design, review and continuous quality process should be inclusive of all program teaching staff through regular interactions, and involve the on-going input and feedback of the student body. Performance assessment at every level should involve a variety of measures as well as input from an appropriate range of stakeholders and drive the improvement cycle.

The overall goal of the learning design process is to ensure that the curriculum *as a whole* addresses the graduate outcomes set for the program in a substantial, coherent and explicit way, emphasising contextual relationships. For example, in relation to communication skills development, it would not be sufficient to expect an adequate skill level to be established within one or two dedicated academic units at particular points in the program. Nor would it be sufficient to say that all or most of the academic units involve communication in one form or another and no further explicit attention is necessary.

As well as a pervading expectation of good communication practices, there should be a series of structured exercises (such as team projects and outreach activities) expressly requiring effective communication of an advanced order and using engineering issues as the vehicle, both at technical level between Professional Engineers, Engineering Technologists and Engineering Associates/officers, and at non-technical level with other professionals or with the community generally. Such exercises should involve both conveying complex intelligence, and receiving and responding to it. Multiple opportunities should be provided, for students with different temperaments and backgrounds.

3.3.6. Approach to Assessment and Performance Evaluation

The development of assessment and performance monitoring systems must be an integral part of the overall educational design process for any particular program.

There should be evidence that the assessment tools and evaluation processes within individual academic units are rigorously aligned with the designated learning outcomes for the unit.

At program level, assessment measures from within individual academic units along with a range of inputs, feedback and performance measures gleaned from the full range of constituencies will come together to provide multi-dimensional data appropriate for evaluating performance against the standards set for each of the targeted educational outcomes. Substantiating delivery of the prescribed outcomes in this way will validate satisfactory attainment of the Stage 1 competencies and thus ensure that the generic attributes specified in the Accreditation Policy are developed to a sufficient degree in all graduates.

Summative and formative assessment tools may include examinations, tests, quizzes, project reports, self, peer, and mentor appraisals, portfolios and journals, oral examinations and interviews and behavioural observations. Other sources of performance data at both the level of academic unit and for the program as a whole will include surveys, focus and discussion groups, questionnaires and professional interviews. Collectively these widespread measures will provide the inputs for performance evaluation and monitoring delivery of outcomes at all levels.

It is important that students be required to perform in at least one (and preferably several) assessable situations involving major and wide-ranging challenges, drawing on knowledge and capability from different subject areas.

There should be a documented system for setting, reviewing and monitoring the delivery of learning outcomes associated with engineering practice exposure.

The assessment regime should address the full range of graduate capabilities, including personal and professional skills development.

A rigorous moderation process should be in place to monitor and manage the assessment processes within academic units.

The processes for determining Honours/Distinction or any other specific performance recognition should be clearly documented, and assure the performance standards of honours graduates is comparable with benchmark practice standards.

3.3.7. Management of Alternative Implementation Pathways and Delivery Modes

There must be rigorous processes for monitoring and managing alternative implementation pathways within a particular program definition, and for assuring the equivalence of educational outcomes for the program as a whole. Such alternative implementation pathways will range from specialised entry routes and elective academic units within an established home campus program right through to an offshore or remote campus offering of such a program.

3.3.8. Dissemination of Educational Philosophy

The educational design process should be properly documented and made available in appropriate form to each category of stakeholder. For students enrolled in a particular academic unit, this would mean a clear description of expected learning outcomes for the unit, the way in which learning activities will contribute to achievement of these outcomes and how performance against the target outcomes will be assessed. In addition such documentation should demonstrate how the academic unit learning outcomes are tracked to ensure these aggregate systematically to deliver the graduate outcomes specified for the program as a whole. Dissemination of this holistic view of the educational design would normally be through published academic unit learning guides.

Systematic documentation of the educational design is crucial as educational institutions consider alternative implementation pathways to cover initiatives such as distance, workplace, cooperative and offshore delivery options and to provide for recognised articulation routes. Formalised mapping of unit learning outcomes against the targeted educational outcomes of a program and thorough learning design at the academic unit level provides an elemental breakdown of the learning processes. Such a breakdown facilitates the task of establishing the equivalence and validity of alternative implementation pathways. Examples could be the consideration of prior or concurrent learning in an industry setting or arguing the validity of alternatives to the traditional laboratory learning offered at a home campus.

3.3.9. Benchmarking

Engineering schools should engage in some form of comparative analysis to ensure that exit-level performance standards are comparable with national practice, and preferably international practice for the full range of graduate capabilities. Comparative analysis could include exchanges of teaching and assessment materials, discussion forums, visitation teams and/or the use of external examiners, if so desired. Beyond this, more systematic benchmarking could help in identifying best practices and specific directions for improvement. The accreditation process will evaluate program standards, but education providers should do so as part of the process of setting the performance criteria and monitoring targeted graduate outcomes, and not rely on the accreditation system for this.

3.3.10. Formal Processes for Review and Revision of an Existing Program

There must be formal approval processes associated with program and curriculum planning and review, with due reference to demand analysis, the input of external stakeholders, students and quality management processes.

3.3.11. Student Administration and Support

There must be an admissions system that ensures an acceptable standard of entry for students from appropriate educational backgrounds.

There must be policies and processes for the acceptance of transfer students, validation of formal prior learning and analysis of prior learning or concurrent learning in non-formal settings.

The admission system must adequately publicise the qualifications required for entry and ensure that only qualified candidates are admitted.

There should be formal policies and processes for tracking student progress, issuing advice and the provision of timely warnings to students at risk, systematic remediation, exclusion and appeal.

The records management system must enable auditing of the above processes at any time and provide confirmation of integrity.

4. REFERENCES

1	S02EA_Curr	Accreditation Criteria Summary
2	P02EA_Curr	Engineers Australia Policy on Accreditation of Professional Engineering Programs
3	G07EA_Curr	Fields of Specialisation
4	P05EA	Engineers Australia National Generic Competency Standard - Stage 1 Competency Standard for Engineering Associate
6	G05EA_Curr	Alternative Implementation Pathways
7		Engineers Australia, Accreditation Board Accreditation Management System, List of Documents
8		AQF Handbook Fourth edition 2007 http://www.aqf.edu.au/