ENGINEERS AUSTRALIA

ACCREDITATION BOARD

ACCREDITATION MANAGEMENT SYSTEM

EDUCATION PROGRAMS AT THE LEVEL OF

ENGINEERING TECHNOLOGIST

Document No. S02ET

Title Accreditation Criteria Summary

ENGINEERS
AUSTRALIA

DOCUMENT STATUS

Revision	Prepared by	Authorised by	Issue Date
1	Associate Director – Accreditation. Professor Alan Bradley.	Chair of the Accreditation Board. Professor Robin King.	February 2009

Table of Contents

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 for those responsible for the accreditation function. An index of the documents comprising the Accreditation Management System is provided in

'Engineers Australia – Accreditation Management System – Document Listing'

The key criteria underpinning the accreditation process are summarised in the discussion to follow. 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.

2. CONTEXTUAL SETTING

The generic attributes defined in the Engineers Australia Policy on Accreditation of Engineering Technologist Programs, (Reference 1), and more particular the Engineers Australia National Generic Competency Standards – Stage 1 Competency Standard for Engineering Technologist (Reference 2) provide a common platform for the design of education programs aimed at preparing students for practice in a particular domain of engineering technology. Graduates must have in-depth knowledge and understanding within a field engineering technology and its applications. This must include advanced knowledge and skills in at least one specialist area of application or in technical management within the field. In addition, graduates must be equipped with the engineering abilities and professional attributes underpinning all domains of engineering practice.

The Stage 1 Competency Standard also provides a tool for direct assessment, in a generic sense, of the preparedness of a candidate not holding an accredited or recommended qualification for entry to the profession.

The targeted graduate capabilities for a program in a particular discipline must, in a generic sense, be built on and reflect these Stage 1 competencies. Graduate capabilities would be expected to embrace enabling skills and knowledge, depth of knowledge and understanding of the selected field of technology and its applications, engineering application skills as well as personal and professional capabilities. The accreditation criteria have been devised as a means of assessing the potential for a particular engineering education program, delivered within an appropriate educational setting, to deliver graduates equipped with the Stage 1 competencies defined in Reference 2.

The assessment of graduate outcomes by an educational institution will be multi-dimensional and based on performance measures, feedback and inputs distributed throughout the program of study. The accreditation criteria address inputs, content, and processes as well as direct outcomes. As to be expected the criteria correlate strongly with the Stage 1 competencies and associated performance indicators.

3. THE ACCREDITATION CRITERIA

The criteria for accreditation can be listed in point form as follows.

3.1. The Operating Environment

- Organisational structure and commitment to engineering education.
- Academic and support staff profile.
- Academic leadership and educational culture.
- Facilities and physical resources.
- Funding.
- Strategic management of student profile.

3.2. The Academic Program

- Specification of educational outcomes.
- Titles of Program and award.
- Program structure and implementation framework.
- Curriculum.
- Exposure to engineering practice.

3.3. Quality Systems

- Engagement with external constituencies.
- Feedback and stakeholder input to continuous improvement processes.
- Processes for setting and reviewing the educational outcomes specification.
- Approach to educational design and review.
- Approach to assessment and performance evaluation.
- Management of alternative implementation pathways and delivery modes.
- Dissemination of educational philosophy.
- Benchmarking.
- Approval processes for program development and amendment.
- Student administration.

Performance indicators against each criterion are introduced in Section 4 of this document.

Detailed discussion against each criterion is provided in the guidelines of Reference 3.

Reference 4 provides guidance in the preparation of accreditation submission documentation, and again systematically follows the accreditation criteria.

The criteria under Section 3.2 above, '*The Academic Program'*, will need to be addressed independently for the evaluation of each individual program offered by a provider. The remaining criteria under the headings of *'The Operating Environment*' and *'Quality Systems'* must again be applied to each program however in many cases, a unified analysis either for all programs or groups of programs, will be appropriate because of a common operating environment.

4. ACCREDITATION CRITERIA – INDICATORS OF PERFORMANCE

The performance indicators listed in the following table provide an interpretation of the expectations associated with each assessment criterion. These performance indicators are included for guidance only and are not meant to be prescriptive. ***In submitting for accreditation, educational institutions are not expected to respond rigorously to every indicator. Sufficient information is expected to be provided such that an evaluation panel is able to make a holistic judgement***

against the criteria.

The guidelines of Reference 3 more clearly demarcate the absolute requirements for accreditation from the expectations of performance. Again the emphasis is on encouraging innovation and diversity in educational design and delivery.

4.1. The Operating Environment

Criteria	Performance Indicators
4.1.1 Organisational structure and commitment to engineering education	• Substantive, organisational entity with clearly designated and devolved accountability for leadership and management of engineering education programs. • Long term, institutional commitment and strategic management to assure the development of the engineering discipline and the provision of appropriate resources. • Formally constituted committee structures and mechanisms for program review and approval.
4.1.2 Academic and support staff profile	• Adequate academic staff numbers, balanced profile across academic appointment levels. • Appropriate student/staff ratios. • Effective workload policies and practices. • Effective student learning support mechanisms. • Gender balance. • Appropriate depth, mix and distribution of qualifications, experience and engineering practice exposure, scholarship and professional standing. • Match of staff competency profile to the range of specialist program offerings. • Appropriate policy and record of staff development – both pedagogical, and professional skills. • Staff awareness of gender and cross-cultural issues, inclusive teaching approach. • Strategic use of sessional and industry presenters to enrich staff skills profile and the exposure of students. • Adequate student counselling and advisory services. • Appropriate technical and administrative support staff profiles.
4.1.3 Academic leadership and educational culture	• Effective leadership of a cohesive teaching team, driving the educational design and improvement process at individual program level. • Program team inclusive of all teaching staff. • Dynamic, cooperative learning community. • Progressive pedagogical framework, adoption of best practice. • Cooperative industry and community outreach. • Interlinked research and teaching programs. • Staff role modelling the generic engineering attributes. • Inclusive environment – gender, culture, social differences – encouraging diversity and the development of the individual. • Developing staff as learning facilitators in a cooperative learning environment.

4.1.4 Facilities and physical resources	• Appropriate experimental and project based facilities to support both structured and investigatory learning within the specified field of practice and specialisation. • Adequate IT facilities and support. • Access to simulation, visualisation, analysis, design, documentation, planning, communication and management tools as well as test and measurement equipment and information resources appropriate to current industry practice. • Learning support facilities appropriate to the development of the full range of educational outcomes and matching the needs of the individual.
4.1.5 Funding	• Sound business planning accommodating current commitments and proposed developments. • Appropriate funding formula for distribution to and within the engineering school. • Ongoing viability - ability to deliver current commitments and projected developments.
4.1.6 Strategic management of student profile	• Viable student numbers and trends. • Appropriate admission, retention and progression record, Honours and graduation rates commensurate with performance indicators. • Rigorous processes for analysis, assessment and verification of prior learning for advanced standing.

4.2. Academic Programs

Criteria	Performance Indicators
4.2.1 Specification of educational outcomes	• Clearly identified field of engineering technology and area(s) of application. • Explicit and comprehensive specification of program objectives and targeted graduate capabilities. • Satisfactory rationale based on analysis of industry and community needs, trends in engineering practice and benchmark indicators. • Targeted graduate capabilities embracing the balanced development of enabling skills and knowledge; personal and professional capabilities; engineering application skills; in-depth knowledge and understanding appropriate to the nominated field of technology (or fields of technology supporting the associated industry sector) and/or its management. • In-built performance indicators commensurate with an appropriate monitoring methodology. • Targeted graduate capabilities reflecting the Stage 1 Competency Standard. • Explicit mapping of educational outcomes to demonstrate adequate level of attainment of the Engineers Australia Generic Attributes.
4.2.2 Titles of program and award	• Titles appropriate to a program of engineering technology education. • Match of title to designated field of practice, program content and specialist focus.
4.2.3 Program structure and implementation framework	• Structure compatible with the delivery of the specified outcomes. • Dual degree pathways providing valid engineering outcomes. • Alternative implementation pathways such as electives, major and minor sequences, cooperative mode, project/thesis options, workplace learning, distance mode and articulation routes providing equivalence of learning outcomes. • Flexible structure adaptable to student backgrounds and individual learning abilities. • Internationalised approach. • Grading of learning experiences over program duration to develop independent learning skills.

4.2.4 Curriculum	Appropriate range, depth, and balance of learning to provide: **ENABLING SKILLS AND KNOWLEDGE DEVELOPMENT** • Developing underpinning capabilities in: - mathematics, - physical, life and information sciences, - engineering sciences supporting the nominated field(s) of technology, • Tackling technically challenging problems in the area of specialisation. • Appreciation of the need to apply fundamental knowledge to ongoing development and to new technologies relevant to the area of application. **IN-DEPTH KNOWLEDGE AND UNDERSTANDING OF NOMINATED FIELD(S) OF TECHNOLOGY AND ASSOCIATED APPLICATION** • Appropriate range and depth of learning in all foundation aspects of a nominated field of engineering technology and its applications, or of the fields of technology supporting an associated industry sector. • Application of enabling skills and knowledge to the solution of technological problems, situations and challenges within the nominated technology field(s). • Meaningful engagement with current practices, issues and developments within the nominated field(s) of technology. • Advanced knowledge and capability development in one or more areas of application within the nominated field(s) of technology – OR - • Formal knowledge and skills development in the management of technical operations underpinning the nominated field(s) of technology or the associated industry sector. **PERSONAL AND PROFESSIONAL SKILLS DEVELOPMENT** • Embedded, cohesive approach addressed by the curriculum as a whole with particular emphasis on developing: - an ability to communicate with the engineering team and the community at large; - information literacy and the ability to manage information and documentation, - a capacity for creativity and innovation; - an understanding of and commitment to ethical and professional responsibilities; - an ability to function as an individual and as a team leader and member in multi-disciplinary and multi-cultural teams; - a capacity for lifelong learning and professional development; - appropriate professional attitudes. **ENGINEERING APPLICATION EXPERIENCE** • Pervasive engineering application activities in the technical domains underpinning the nominated field(s) of technology and its applications and directed at developing: - an ability to undertake problem identification, formulation, investigation and solution including quantification of assumptions, identification of underlying causes and recognition of bounds of personal competence; - an ability to apply, manage interactions and adapt technology within a broad application context; - proficiency in design of devices, components, systems, equipment, facilities or installations appropriate to the nominated field(s) of technology; - an ability to contribute substantially to the conduct of an engineering project within bounds of time, budget, performance and quality assurance; - an ability to operate within a broad contextual framework accommodating social, cultural, ethical, legal, political, economic and environmental responsibilities and the principles of sustainable development and safety imperatives; - skills in operating within a business environment, organisational and enterprise management and in the fundamental principles of business.

	PRACTICAL AND 'HANDS-ON' EXPERIENCE • Embedded experiential learning activities, appropriate to the nominated field(s) of technology and its applications, and directed at developing: - an appreciation of the scientific method, the need for rigour and a sound theoretical basis; - a commitment to safe and sustainable practices; - skills in the selection and characterisation of engineering systems, devices, components and materials; - awareness and competence in the use of appropriate engineering resources tools and techniques, appreciation of accuracy and limitations; - familiarity with and competence in the use of mathematical and physical models, appreciation of applications and limitations; - proficiency in the design and conduct of experiments and measurements, and in the analysis and interpretation of data; - proficiency in appropriate laboratory procedures; the use of test rigs, instrumentation and test equipment, strong grasp of the principles and practices of laboratory safety; - ability to perceive and eliminate or compensate for possible sources of error, and to quantify their significance; - skills in documenting results, analysing credibility of outcomes, critical reflection, developing robust conclusions, communicating outcomes.
4.2.5 Exposure to engineering practice	• Exposure to engineering practice (other than formal work placement), used as an integrated learning activity embedded within academic units and contributing in a defined and understood manner to the delivery of graduate capabilities. • Formal work placement requirements documented with appropriate learning outcome targets. • Appropriate systems for recording, tracking and assessing delivery of learning outcomes.

4.3. Quality Systems

Criteria	Performance Indicators
4.3.1 Engagement with external constituencies	• Ongoing, regular input to the establishment and review of outcome targets, educational design and performance assessment from a formal advisory body which includes representation of industry, the community and professional organisations. • External stakeholders facilitating appropriate engineering practice exposure opportunities for students. • Productive industry linkages through collaborative project work and research contributing to the professional development of staff and students.
4.3.2 Feedback and stakeholder input to continuous improvement processes	• Use of staff-student consultation forums, focus groups or other direct input mechanisms for on-going review and improvement. • Appropriate use of survey instruments and other means of obtaining systematic feedback. • Graduate, alumni, employer, advisory body and community input mechanisms. • Students as true partners in a culture of continuous quality improvement.
4.3.3 Processes for setting and reviewing the educational outcomes specification	• Holistic, outcomes driven approach. • Addressing the full range of graduate capabilities. • Controlled by the generic attributes framework and aligned with the Stage 1 Competency Standard. • Specific to each individual program. • Systematic review process inclusive of all teaching staff and the ongoing input from external constituencies. • Ongoing review of benchmark practices, industry needs and demand.

4.3.4 Approach to educational design and review	• Continuous improvement process involving all teaching staff. • Driven by a clear understanding of the 'big-picture' – program objectives and graduate capabilities. • Documented records of improvement processes. • Closing the loop within academic units – learning outcomes - learning activities – assessment. • Systematic mapping of learning outcomes from academic units, aggregating to deliver targeted graduate capability outcomes. • Progressive emphasis on independent learning, reflective practices, critical review, peer and self assessment as the program progresses.
4.3.5 Approach to assessment and performance evaluation	• Integral to the educational design processes. • Adequate range and depth of assessment processes, referenced to relevant standards or benchmarks, including appropriate use of reflective, student self-analysis against targeted learning outcomes and/or graduate capabilities. • Tracking and monitoring the attainment of the full range of graduate capabilities including personal and professional skills and standards of technical competence. • Tracking the performance measures within academic units and how these aggregate to satisfy the capability metrics for the program as a whole. • Rigorous moderation processes. • Systematic review. • Appropriate mechanism for determination of Honours level performance.
4.3.6 Management of alternative implementation pathways and delivery modes	• Adequate processes for analysing, monitoring and ensuring the equivalence of alternative implementation pathways and delivery modes.
4.3.7 Dissemination of educational philosophy	• Adequate documentation of the targeted program outcomes and the educational design philosophy and the associated mapping processes in program handbooks and records, and/or in individual academic unit guidelines. • Clear mapping of the component contributions from individual academic units to the graduate capability specification. • Clear linkage between learning outcome targets, learning activities and performance assessment within the individual academic unit. • Appropriately informing all stakeholders.
4.3.8 Benchmarking	• Appropriate processes for comparing standards of educational outcome targets and performance criteria against the expectations of employers as well as national/international practice.
4.3.9 Approval processes for program development and amendment	• Formal processes for: - new program approval – demand analysis, establishing rationale, outcomes specification, educational design, - program amendment.
4.3.10 Student administration	• Robust systems for: - student records data management, - individual student progress monitoring, performance warning and exclusion, - student advisory processes, - retention and progression monitoring, - defining and maintaining student admission standards.

REFERENCES

1 P02ET Engineers Australia Policy on Accreditation of Professional Engineering Programs

2 P05ET Engineers Australia National Generic Competency Standards - Stage 1 Competency Standard for Engineering Technologist

3 G02ET Accreditation Criteria Guidelines

4 G06ET Preparation of Submission Documentation