PROFESSIONAL PRACTICE – NOTES

Competency

Competency	Skill
Broader, many skills, knowledge elements	Specific
Macro level	Micro level
Competency is a latent trait defined by a developmental progression that is a manifestation of the underlying latent trait.	
A competence is … is a latent trait that defines a person's capacity to perform tasks and demonstrate skills. It is a latent or 'hidden' personal attribute that can only be inferred from observing how much and how well a person manifestly performs a set of skills related to the trait in a range of contexts"	

Monash Graduate Attributes

Monash University prepares its graduates to be:

(1.) responsible and effective global citizens who:

- engage in an internationalised world
- exhibit cross-cultural competence
- demonstrate ethical values

(2.) critical and creative scholars who:

- produce innovative solutions to problems
- apply research skills to a range of challenges
- communicate perceptively and effectively.

Professional Practice interactions

(James Trevelyan) Research reveals three groups of performances in engineering work:

Group 1: hands-on interactions with tools, measuring instruments and objects.

Group 2: cognitive interactions with abstract object representations, including analysis, modelling, programming, design, and technical problem-solving.

Group 3: socio-technical interactions with other people to collaborate in, and coordinate group 1 and 2 performances, also to advocate for particular requirement interpretations and resources.

Engineering Learning Outcomes

Upon successful completion of this course it is expected that you will be able to:

		Group 1, 2 or 3
1	understand and proficiently apply the relevant sciences and scientific methods in at least one specialist engineering practice area, to design solutions to complex problems	2
2	identify, interpret and critically appraise current developments and advanced technologies and apply knowledge of these to at least one specialist area	2
3	identify and synthesise the constraints posed by economic factors, safety considerations, environment impacts and professional standards on engineering practice and use them to inform professional judgements	2

4	determine, analyse and proficiently apply theoretical and numerical analysis of phenomena to predict, design, control and optimise the performance of engineering systems	2
5	research, identify, conceptualise, investigate, and interpret knowledge from modern engineering tools and techniques to synthesise a coherent approach to the solution of a problem and/or the design of a project	2
6	identify and critically evaluate the performance of an engineering system in terms of economics, safety and the social and physical environment, and implement approaches to minimise any adverse impact leading to sustainable development	2
7	understand and proficiently apply a systems approach to the design cycle, addressing the broad contextual constraints, leading to sustainable development	2
8	show awareness of and ability to proficiently apply project management tools and methodologies to the planning and execution of projects leading to engineering solutions of a professional standard	2
9	develop and implement creative and innovative approaches to problem-solving	2
10	communicate effectively on both technical and general issues with peers, associates, clients and the general public	3
11	operate effectively and professionally within a team environment	3
12	plan, organise and use resources efficiently	2
13	demonstrate the highest standards of personal performance	n/a
14	demonstrate commitment to lifelong learning and professional development	n/a
15	understand the responsibilities of engineers to the community, the engineering profession and the industrial and business world	3
16	demonstrate commitment to ethical standards and legal responsibilities to the community and the profession	3

Note: no group 1 interactions in the 16 engineering learning outcomes.

Check – Industry Advisory Board?

Check – balance between what should be taught at uni and what should be deferred more to industry

Handbook

https://handbook.monash.edu

Bachelor Programs and their associated professional practice unit.

Aerospace	MEC4404	Environmental	CIV4212
Biomedical	MEC4404	Materials	MTE4201
Chemical	CHE4161	Mechanical	MEC4404
Civil	CIV4212	Robots and Mechatronics	TRC4002
Electrical and Computer Systems	ECE4099	Software	FIT3170

On successful completion of this unit, you should be able to:

	Department of Chemical and Biological Engineering	**Dept of Electrical and Computer Systems Engineering**
	CHE4161 Engineer in Society	**ECE4099 - Professional practice**
1	Appraise the role of a professional engineer, Code of Conduct and Ethics.	acquire and comprehend the fundamental knowledge of the role of an engineer as a manager - skills, roles, styles, techniques, in the context of an organisation.
2	Deliberate the factors affecting the market for specific products and an understanding of market risks to industries involved in manufacturing businesses.	analyse and evaluate different project alternates by applying a range of techniques.
3	Demonstrate teamwork skills for working in group projects.	comprehend and apply accounting fundamentals, prepare and analyse basic financial statements to enhance business decision making.

4	Design the normal project timeline using a GANNT chart, including the hurdles required for financing a new project.	comprehend and explain the basics of marketing principles and techniques of strategic business planning.
5	Appraise the approval process for government jurisdiction for environmental assessment and a plant safety case and have some understanding of the key points of environmental law, and occupational health and safety legislation.	analyse and explain important legal and cultural aspects of contract, negligence, and intellectual property.
6	Demonstrate the ability to carry out the risk assessment and formulate the risk management for a process plant.	demonstrate professional behaviour that requires adherence to the engineering code of ethics.
7	Demonstrate the ability to produce an environmental improvement plan for a process and carry out a HAZOP of a part of a process and draw a fault-tree diagram.	Analyse the environmental impact and sustainability of a project.
8	Demonstrate the ability to estimate the equipment costs for a process, the plant capital and operating costs, including a cash flow analysis and calculate the net present value of a project using discounted cash flow and determine its financial viability.	Show commitment to working in a team.
9		Communicate effectively by making professional presentations.

	Department of Mechanical and Aerospace Engineering	**Department of Electrical and Computer Systems Engineering (Mechatronics)**
	MEC4404 – Professional practice	**TRC4002 - Professional practice**
1	Appreciate the ethical responsibilities of a professional engineer, together with the role and contribution of engineers in society.	Describe the skills, roles, styles and techniques of an engineering manager in the context of an organisation.
2	Apply the legal, health and safety knowledge of a professional engineer.	Assess different project management techniques.
3	Apply the basics of engineering economics, particularly the time value of money, simple and compound interest rates, rates of return and cash flows.	Apply accounting principles to analyse basic financial statements that enhance business decision making.
4	Demonstrate the ability to transit from university to a professional engineering role, successfully completing job applications, interviews, career planning and performance management.	Describe the basic marketing principles and techniques of strategic business planning.
5	Appreciate the need for sustainable development and assess the environmental impact of engineering projects in the context of sustainable development.	Analyse important legal aspects of contract, negligence, and intellectual property.
6		Describe the elements of professional behaviour and the engineering code of ethics.

	Department of Architecture	**Department of Civil Engineering – *no PP - capstone***
	ARC5201 - Professional practices	**CIV4212 - Civil and environmental engineering practice**
1	Demonstrate an understanding of the financial, business and ethical contexts shaping local and global architectural practice.	Appraise a multidisciplinary engineering project brief as part of a design team.
2	Demonstrate familiarity with management practices and their application to the development of the built environment.	Generate concept designs that meet multidisciplinary criteria as part of a team.
3	Demonstrate awareness of the building industry and alternative methods for procurement.	Design components of a multi-disciplinary engineering project.
4	Demonstrate an understanding of professional ethics in relation to architectural practice..	Construct construction-standard details and drawings of the design.
5		Generate oral, written and visual communication skills suitable for professional practice.

	Faculty of Information Technology	
	FIT3170 - Software engineering practice	
1	Describe industry-standard team-based project management methodologies and apply them across a multi-functional team to achieve optimal project progress	
2	Apply soft skills when engaging stakeholders in a consistent and professional manner to determine functional and non-functional requirements	
3	Plan and manage the full range of activities in a software engineering project in accordance with the development methodology	
4	Compare and analyse appropriate industry-standard technologies to determine the optimal combination of software required to support project development	
5	Assess aspects of quality assurance that are relevant to the context of the project, and evaluate strategies for ensuring quality standards are met for end users	
6	Deliberate professional issues occurring within the development and deployment of software applications, and identify appropriate actions based on human factors, relevant law and industry codes of ethical behaviour.	

Data driven v data informed

Questionnaire

INTRODUCTION

We are reworking our Professional Practice unit, which engineering students take in their final year. We would appreciate your viewpoints on what topics to include and what to omit.

Your company name:	
Which engineering fields your company offers (select as many as apply)	Aerospace Biomedical Chemical Civil Electrical and Computer Environmental Materials Mechanical Robotics and Mechatronics Software
Please choose one of the disciplines and consider which topics to include for that speciality:	Aerospace Biomedical Chemical Civil Electrical and Computer Environmental Materials Mechanical Robotics and Mechatronics Software

Engineering practice can be organised into three groups of performances 1. hands-on interactions 2. cognitive interactions 3. socio-technical interactions	

Socio-technical interactions

Why optional? Relevance?

Content	Current amount of	Is this topic appropriate for a	If yes, should there be more or less of	Should this topic be deferred to industry?

	hours in a PP unit	professional practice unit?	this content in a PP unit?	
Measuring instruments	0	Yes no	More less about the same	• Yes, do less at uni and leave it to us • Yes don't do any at uni and leave it to us • Yes, do the same at uni but still leave it to us • No, you can do it

Accreditation Feedback (deleted)

APPENDIX 1 – ENGINEERS AUSTRALIA AND PROFESSIONAL PRACTICE

An extract from AMS-MAN-10 Accreditation Criteria User Guide – Higher Education, pages 16 – 19.
https://www.engineersaustralia.org.au/sites/default/files/2022-07/accreditation-criteria-guide-higher-education.pdf

3.4 AP4 Engagement with professional practice

Purpose: To describe how the graduate capabilities related to professional practice are developed throughout the entire program

Suggested evidence of attainment:
AP4 and AP5 should be considered together

a. Engagement with professional practice (other than formal work placement), used as an integrated learning activity embedded within units of study and contributing in a defined manner to the delivery of graduate capabilities matching the specified learning outcomes

b. Formal work placements, where implemented, are documented with appropriate intended learning outcomes traced to the applicable EA Stage 1 Competency Standard

c. Appropriate systems for recording, tracking and assessing delivery of the intended learning outcomes (such as e-portfolios)

d. Experience with the working of engineering teams

Sound professional judgement is expected of experienced engineers, defining the vision for the professional journey from student engineer to competent practitioner. An engineer acts to meet an obligation in relation to an engineering task, requiring professional judgement to be applied and a decision to be made. The result is offered as a responsible, reliable and useful output of a professional, fit for downstream use by others.

The guiding objective for engagement with professional practice (EPP) in engineering education is to initiate the development of sound professional work practices and methods that underpin reliable professional judgement and decision-making, and to embed these work practices and methods so that they continue beyond the education program. Student engineers need in addition to knowledge, formative experiences of how engineering professionals:

a) Think, work and continually learn

b) Develop professional judgment

c) Make decisions while conforming with the EA Code of Ethics

d) Earn the trust of all stakeholders in those decisions

Professional practice experiences need to be delivered in environments (which may be simulated, virtual, industry, or a mix of these) that provide experiential learning. These environments are materially different from the usual education environment. These differences, which offer guidance to the development of simulated or virtual environments, include:

- Systems for managing work – all engineering organisations have documented work practices and procedures that facilitate the orderly management of the professional task
- Professional communications – communications in the professional workplace are very different from student communications, especially when communicating with clients
- Modeling of professional behaviours – constructive role models of professional behaviour are powerful in the development of professionalism

- Constraints of commerce – in the delivery of an engineering task, engineers do not work in isolation, interacting with other business functions that are part of the broader business team, constraining how engineers deliver their outputs
- Experiences "in the wild" – the professional work environment is subject to many inputs and disturbances that are not under the control of the engineering team, potentially disrupting normal work activities

Suitable formative experiences may be provided both from within the taught curriculum and from a separate professional environment. The nature of the separate environment and the extent of its engagement is not prescribed, but Engineers Australia strongly advocates that all student engineers be required to build a meaningful portion of their experiences from workplaces where engineers exercise professional judgment in the practice of engineering.

Preparation must begin within the taught curriculum to provide a practice framework for subsequent experiential learning, regardless of where and how the formative professional experience is obtained. Engagement with professional practice must be an integral learning activity within the education design and make a significant and planned contribution to the delivery of graduate capabilities. The objectives of EPP need to be understood by all stakeholders (student engineers, staff and supervising professional engineers), they must be documented as formal learning activities within the program curriculum and mapped to the applicable EA Stage 1 Competency Standard.

There should be formal monitoring and assessment of the learning outcomes associated with EPP through, for example, a journal or portfolio system where student engineers record and reflect on their experiences against the targeted graduate capabilities.

EPP must culminate in a set of meaningful experiences that result in the habituation of professional working styles through placement in activities engaged in actual or simulated commerce, internships, volunteering or similar activities.

In addition, EPP could include, but is not limited to, a combination of the following:

1) Systematic contact with practising professionals, for example, through on-going project reviews, mentoring, or professional society activities
2) Engineering information management, especially management of an engineering baseline
3) Direct industry input to authentic problem-solving, projects and evaluation tasks
4) Industry-based investigations and case studies, including final year projects
5) Industrial site visits that contribute to learning outcomes
6) Inclusion of staff with industry experience in curriculum delivery
7) Guest lectures by industry practitioners
8) Application of industry standards, codes, practices and methods
9) Structured interviews of engineering professionals

The outcome should be that student engineers are able to aggregate different experiences towards their portfolio of EPP. For maximum pedagogical value, education programs should be designed to enable student engineers to complete this requirement prior to the final study period (semester, trimester, term, etc). The recommended EPP is nominally the equivalent of 60 days (12 weeks) at the Professional Engineer level, 40 days (8 weeks) at the Engineering Technologist level and 30 days (6 weeks) at the Engineering Associate level in a workplace placement. For accreditation, documentation must be provided explaining how the various experiences contribute to the recommended EPP equivalent period (e.g. 60 days, 40 days or 30 days), and how they contribute to the overall education design. The overall EPP experiences should enhance a graduate's capacity to move with ease into a professional workplace.

Where EPP is incorporated within the four-year equivalent curriculum through credit-bearing units of study, it must embody assessable requirements comparable with other curriculum elements that attract similar credit. Where elements of EPP occur outside of credit-bearing coursework, appropriate assessment of claims against the professional outcomes must likewise be demonstrable to an accreditation panel.

Integrated exposure to professional engineering practice, including management and professional ethics (approximately 10%) – Professional engineer. (AMS-MAN-10 Accreditation Criteria User Guide – Higher Education, p 20).

Areas of content (student effort)	**Proportions of Learning: Professional Engineer**
Underpinning mathematics, science, engineering principles, skills and tools appropriate to the discipline of study and qualification	≥ 40%
Engineering design and projects	≈ 20%
An engineering discipline specialisation	≈ 20%
Integrated exposure to professional engineering practice, including management and professional ethics (approximately 10%)	≈ 10%
More of any of the above elements, or other elective studies	≈ 10%

These proportions are not mutually exclusive. While some are principally related to content

EA STAGE 1 COMPETENCIES

Stage 1 competencies and elements of competency

1. **Knowledge and skill base**
   1.1. Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.
   1.2. Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline.
   1.3. In-depth understanding of specialist bodies of knowledge within the engineering discipline.
   1.4. Discernment of knowledge development and research directions within the engineering discipline.
   1.5. Knowledge of engineering design practice and contextual factors impacting the engineering discipline.
   1.6. Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline.
2. **Engineering application ability**
   2.1. Application of established engineering methods to complex engineering problem solving.
   2.2. Fluent application of engineering techniques, tools and resources.
   2.3. Application of systematic engineering synthesis and design processes.
   2.4. Application of systematic approaches to the conduct and management of engineering projects.
3. **Professional and personal attributes**
   3.1. Ethical conduct and professional accountability.
   3.2. Effective oral and written communication in professional and lay domains.
   3.3. Creative, innovative and pro-active demeanour.
   3.4. Professional use and management of information.
   3.5. Orderly management of self, and professional conduct.
   3.6. Effective team membership and team leadership.