

EN421 RESEARCH PROJECT B: SUBJECT OUTLINE

Course(s)	Bachelor of Mechanical Engineering (NQF Level 8)
Subject Name	Research Project B
Subject Code	EN421
Duration	13 teaching weeks, plus 1 examination week and 1 mid-semester week
Contact Hours	6 hours per week (1 hour lecture, 5 hours project)
Credit Points	11
Delivery Mode	On campus
Prerequisites	EN411 Research Project A
Co-requisites	Nil
Subject Coordinator	TBA

Synopsis

This subject continues the undertaking of research that was commenced in Research Project A. It is intended to continue to augment the professional work in the students engineering discipline to form a foundation for future learning and professional development and assist to develop cognitive skills. The subject covers research methods, literature reviews, plans, analysis and presentation. The subject provides an introduction to planning a research investigation, developing testing regimes, and data analysis, interpretation and presentation. The final outcomes of the subject will be creation of a Research Project Thesis.

Subject Topics

Topic 1 provides an overarching framework to planning a research program, outlining the need to develop a schedule for the entire project and to identify the breadth and depth of testing required to generate adequate and reliable data.

Topic 2 outlines the importance of accurate analysis, interpretation and presentation of experimental results and explores the use of regression and correlation as tools to help explain trends in data. The role of hypothesis testing in engineering is introduced.

Topic 3 involves the provision of guidance on structuring and writing the Research Project Thesis and preparing the accompanying audio visual presentation.

Subject Learning Outcomes (SLOs)

On completion of this subject students will be able to:

1. Develop and justify an integrated research plan and select and apply appropriate research methodologies
2. Source and critically evaluate and synthesise research literature to determine the level of contemporary knowledge in a specialist area.
3. Undertake experimentation, data collection through laboratory and/or field studies and/or critical analysis of the literature.
4. Judge the degree to which research outcomes are supported by the research data and form appropriate conclusions and recommendations based on the research.
5. Apply established theories and techniques to present the significance of their research findings and make informed recommendations for future research directions.
6. Create a research report and audio visual presentation that communicates the outcomes of the research to a diverse audience.

Assessment Tasks and Weightings

To obtain a pass grade in this Subject at least 50% overall must be achieved, and at least 40% achieved in the Research Project Thesis.

Students must also refer to the Subject Assessment Details.

Assessment Task 1 requires the development of the *Research Plan*, outlining the proposed research schedule to ensure that the proposed research is achievable. It is worth 10% of the total marks for the Subject.

Assessment Task 2 helps to facilitate the structured development of the research by requiring a *Research Progress Report*, which must include a critical review of the international literature. The progress report will be presented as a concise engineering report. It is worth 20% of the total marks for the Subject.

Assessment Task 3 requires the production of the *Research Project Thesis*. The thesis is the capstone of the degree and be around 6000 words excluding tables, graphs and appendices. It will include ethical and sustainability aspects. It is noted that some theses may vary significantly in length due to the research topic. It is worth 60% of the total marks for the Subject.

Assessment Task 4 provides an opportunity for the *Audio-visual Presentation of the Research Outcomes*. The presentation must include both visual and audio and must be delivered to the student cohort for the Subject. It is worth 10% of the total marks for the Subject.

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism at:

<http://asix.unitech.ac.pg/apps/pnquot/?q=unitech/policies>

Subject Mapping

Subject Learning Outcomes (SLO) are mapped to each of the PNG National Qualifications Framework (NQF), Course Learning Outcomes (CLO), Unitech Graduate Attributes (GA), Assessment Tasks (AT) and Engineers Australia (EA) Stage 1 Competencies.

SLO	SLO to NQF	SLO to CLO	SLO to GA	SLO to AT	SLO to EA Stage 1 Competencies
1	Knowledge and Skills, Applications and Autonomy – NQF8	2, 3, 4	Critical thinker, Technologically savvy	A1	1.3, 1.4, 2.3, 2.4
2	Knowledge and Skills, Applications and Autonomy – NQF8	2, 3, 4	Critical thinker Technologically savvy	A2, A3	1.3, 1.4, 2.3, 2.4
3	Knowledge and Skills, Applications and Autonomy – NQF8	2, 4, 5	Critical thinker Technologically savvy	A2, A3, A4	1.3, 1.4, 1.5, 2.1, 2.2, 2.3, 2.4
4	Knowledge and Skills, Applications and Autonomy – NQF8	2, 3, 4, 5	Critical thinker Technologically savvy	A3, A4	1.3, 1.4, 2.1, 2.2, 2.3, 2.3, 2.4
5	Knowledge and Skills, Applications and Autonomy – NQF8	2, 3, 4, 5	Effective communicator Critical thinker Technologically savvy	A3, A4	1.3, 1.4, 2.1, 2.2, 2.3, 2.4
6	Knowledge and Skills, Applications and Autonomy – NQF8	2, 3, 4, 5, 6, 7, 8	Lifelong Learner A Critical Thinker An effective Communicator Cultural Modernist Morally Upright Technologically Savvy	A3, A4	1.3, 1.6, 2.1. 3.2, 3.3, 3.4, 3.5

Engineers Australia Stage 1 Competencies

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

Graduate Statement

The mechanical engineering graduate will have the skills and ability to systematically apply the engineering knowledge in an ethical and morally responsible manner in providing practical and sustainable solutions to engineering problems while upholding a level of sensitivity to social, cultural, legal and environmental issues in society.

Mechanical Engineering Course Learning Outcomes

The following table is included to demonstrate to mechanical engineering students that their Course Learning Outcomes address all EA Stage 1 Competencies.

The mapping matrix for all subject learning outcomes within the Course, against EA Stage 1

Competencies, provides more detailed information. That matrix is provided separately to students.

Course Learning Outcome	Engineers Australia Stage 1 Competencies
1. Possession of a deep understanding of the sciences, math, information systems and engineering fundamentals that underpin the mechanical engineering discipline.	1.1, 1.2
2. An in-depth understanding of the body of knowledge that forms the mechanical engineering discipline.	1.2, 1.3
3. Collection, synthesis and application of information within the mechanical and related engineering disciplines.	1.4, 1.5, 2.1, 2.3, 2.4, 3.4
4. Undertaking research, analysis & evaluation of ideas and concepts within mechanical engineering.	1.3, 1.4, 1.6, 2.1, 2.3, 2.4, 3.2, 3.4
5. Applying problem solving skills to complex mechanical engineering systems and processes.	1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 2.3
6. Undertake mechanical engineering design and manage engineering projects.	1.6, 2.2, 2.4, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6
7. Communication via multiple media to diverse audiences, undertaking team roles, teamwork and providing team leadership.	2.4, 3.2, 3.3, 3.4, 3.5, 3.6
8. Behaving in an ethical and professional manner and respecting others.	1.6, 2.4, 3.1, 3.4, 3.5, 3.6
9. Being cognisant of the importance of sustainability and the environmental impact of engineering.	1.5, 1.6, 3.1, 3.3, 3.4

Unitech Graduate Attributes

Attribute	Academic dimension	Personal Dimension	Transferable Dimension
1. Lifelong learner	Sustained intellectual curiosity and use of feedback to reflect on their own work.	Sets aspirational goals for personal improvement and career growth.	Takes responsibility for one's learning and development.
2. Critical thinker	Uses rules of inference to analyse complex issues and find	Calmly uses logic and critical thinking, and not emotion, in all	Ability to find solutions to problems by using logical and imaginative thinking.

	solutions.	situations.	
3. Effective communicator	Ability to discuss and debate issues articulately and confidently and convincingly.	Character of producing high quality written essays and oral presentations.	Ability to communicate and negotiate with others and to listen to them.
4. Cultural modernist	Familiarity with international standards and world cultures and human rights.	Tolerance of the religions and cultures of others.	Ability to work in a multicultural setting and comprehension and tolerance of religious and cultural differences.
5. Moral uprightness	Understand and act upon the ethical responsibilities of their actions.	Character of acting in a morally upright way in all situations.	Professional behaviour at all times.
6. Technologically savvy	Familiarity and use of technologies appropriately.	Keeping up to date with innovations.	Character of accepting new technology and quickly adapting to it.

Student Workload

The total workload for the subject for the 'average' student is a nominal 150 hours, based on a 15 week semester with 13 weeks of teaching as per the PNG National Qualification Framework.

Subject Text

Theil, D.V 2014 Research Methods for Engineers, Cambridge University Press, Cambridge

References and Readings

Numerous links are provided within the Subject Topics to research organisations, international universities, YouTube clips, and research databases.

Relevant Unitech Policies

It is important that all students familiarise themselves with the University of Technology Assessment Guidelines including those on plagiarism and other relevant policies via the link:

<http://www.unitech.ac.pg/unitech/policies>