Unit 5001: Research Project

Unit Code: J/615/1502

Level: 5

Credits: 30

Introduction

Completing a piece of research is an opportunity for students to showcase their intellect and talents. It integrates knowledge with different skills and abilities that may not have been assessed previously, which may include seeking out and reviewing original research papers, designing their own experimental work, solving problems as they arise, managing time, finding new ways of analysing and presenting data, and writing an extensive report. Research can always be a challenge but one that can be immensely fulfilling, an experience that goes beyond a mark or a grade, but extends into long-lasting areas of personal and professional development.

This unit introduces students to the skills necessary to deliver a complex, independently conducted research project that fits within an engineering/ manufacturing context.

On successful completion of this unit, students will be able to deliver a complex and independent research project in line with the original objectives, explain the critical thinking skills associated with solving engineering/manufacturing problems, consider multiple perspectives in reaching a balanced and justifiable conclusion, and communicate effectively a research project's outcome. Therefore, students develop skills such as critical thinking, analysis, reasoning, interpretation, decision-making, information literacy, information and communication technology literacy, innovation, conflict resolution, creativity, collaboration, adaptability, and written and oral communication.

Learning Outcomes

By the end of this unit students will be able to:

LO1 Examine the preliminary stages involved in the creation of an engineering/manufacturing research project

LO2 Examine the analytical techniques used to work on all stages of the project and strategies required to overcome the challenges involved in a research project

LO3 Reflect on the impact the research experience could have in enhancing personal or group performance within an engineering/manufacturing context

LO4 Explore the communications approach used for the preparation and presentation of the research project's outcomes.

Essential Content

LO1 **Examine the preliminary stages involved in the creation of an engineering/manufacturing research project**

Setting up the research preliminaries:

Project proposal (note: relevant to the subject of study)

Developing a research question(s)

Selection of project approach and use of relevant research methods (e.g., statistical analysis, surveys, etc.)

Identification of project supervisor

Estimation of resource requirements, including possible sources of funding

Setting key project objectives, goals, and rationale

Stakeholder requirements if any

Development of project specification.

LO2 **Examine the analytical techniques used to work on all stages of the project and strategies required to overcome the challenges involved in a research project**

Investigative skills and project strategies:

Key research methods and rationale, primary and secondary research

Selecting the method(s) of collecting data

Data analysis and interpreting findings

Literature review (e.g., journals and published papers)

Engaging with technical literature (e.g., industry case studies, engineering/manufacturing data reports, professional body publications)

Technical depth

Multi-perspectives analysis

Independent thinking

Statement of resources required for project completion

Potential risk issues, including health and safety, environmental and commercial

Project management and key milestones.

LO3 **Reflect on the impact the research experience could have in enhancing personal or group performance within an engineering/manufacturing context**

Research purpose:

Detailed statement of project aims

Relevance of the research

Benefits and beneficiaries of the research

Professional, legal, social, and ethical aspects of research.

LO4 **Explore the communications approach used for the preparation and presentation of the research project's outcomes**

Reporting the research:

Reporting research undertaken, appropriate use of a suitable referencing method including citation

Preparation of a final project report (including structure, professional format, research vocabulary)

Project oral presentation such as using short presentations to discuss the work with representative audiences (e.g., professional discussions) and conclusions

Project written presentation

Poster development and other equivalent methods.

Learning Outcomes and Assessment Criteria

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td colspan="2">LO1 Examine the preliminary stages involved in the creation of an engineering/manufacturing research project</td><td rowspan="2">D1 Produce a comprehensive project proposal that evaluates and justifies the rationale for the research.</td></tr>
<tr><td>P1 Produce a research project proposal that clearly defines a research question or hypothesis.

P2 Examine the key project objectives, the resulting goals, and rationale.</td><td>M1 Analyse the project specification and identify any project risks.</td></tr>
<tr><td colspan="2">LO2 Examine the analytical techniques used to work on all stages of the project and strategies required to overcome the challenges involved in a research project</td><td rowspan="2">D2 Critically analyse literature sources utilised, data analysis conducted, and strategies to deal with challenges.</td></tr>
<tr><td>P3 Conduct a literature review of published material, either in hard copy or electronically, that is relevant to your research project.

P4 Examine appropriate research methods and approaches to primary and secondary research.</td><td>M2 Analyse the strategies used to overcome the challenges involved in the literature review stage.

M3 Discuss merits, limitations, and pitfalls of approaches to data collection and analysis.</td></tr>
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Pass	Merit	Distinction
LO3 Reflect on the impact the research experience could have in enhancing personal or group performance within an engineering/manufacturing context		
P5 Reflect on the effectiveness and the impact the experience has had upon enhancing personal or group performance.	**M4** Evaluate the benefits from the findings of the research conducted, and the impact on CPD.	**D3** Critically evaluate how the research experience enhances personal or group performance within an engineering/ manufacturing context.
LO4 Explore the communications approach used for the preparation and presentation of the research project's outcomes		
P6 Explore the different types of communication approaches that can be used to present the research outcomes. **P7** Communicate research outcomes in a professional manner for the intended audience.	**M5** Evaluate how the communication approach meets research project outcomes and objectives.	**D4** Critically reflect how the audience for whom the research was conducted influenced the communication approach used for the preparation and presentation of the research project's outcomes.

Recommended Resources

Note: See HN Global for guidance on additional resources.

Print Resources

Belegundu A.D. and Chandrupatla T.R. (2019) *Optimization Concepts and Applications in Engineering.* 3rd Ed. Cambridge University Press.

Breach M. (2008) *Dissertation Writing for Engineers and Scientists.* Student Edition. Pearson Education Limited.

Cassel K. W. (2021) *Matrix, Numerical, and Optimization Methods in Science and Engineering.* Cambridge University Press.

Jana A.K. (2023) *Numerical Methods in Engineering: Theory and Process Applications.* Cambridge University Press.

Vaughan G.D., and Smith I.M. (2006) *Numerical methods for engineers.* CRC Press.

KIRKUP L. (2019) *Experimental Methods for Science and Engineering Students: An Introduction to the Analysis and Presentation of Data.* 2nd Ed. Cambridge University Press.

Leong E.C., Lee-Hsia C.H. and Wee Ong K.K. (2015) *Guide to Research Projects for Engineering Students: Planning, Writing, and Presenting*. Apple Academic Press Inc.

Oberlender G.D. (2014) *Project Management for Engineering and Construction*. 3rd Ed. McGraw-Hill Education.

Qiu M., QIU H., and Zeng Y. (2022) *Research and Technical Writing for Science and Engineering.* CRC Press.

Thiel D.V. (2014) *Research Methods for Engineers.* Cambridge University Press.

Journals

Note: Example journals listed below provide a broad range of articles related to unit content and those relevant for the qualification. Staff and students are encouraged to explore these journals and any other suitable journals to support the development of academic study skills, and subject specific knowledge and skills as part of unit level delivery.

American Journal of Engineering Research

Arabian Journal for Science & Engineering

Scientific Reports

Engineering Reports

Science Progress

Cell Reports Physical Science

Engineering Research Express

European Journal of Engineering and Technology Research

IETE journal of research

Indian Journal of Engineering

International Journal of Indian Research

International Journal of Engineering Research in Africa

International Journal of Engineering Research & Technology

Journal of Engineering in Industrial Research

Journal of Engineering Research

Journal of Engineering Research and Sciences (JENRS)

Journal of Engineering Research and Reports

London Journal of Engineering Research

The Journal of Engineering Research [TJER]

Links

This unit links to the following related units:

Unit 4004: Managing a Professional Engineering Project

Unit 5002: Professional Engineering Management

Unit 5041: Engineering project.