Unit 5002: Professional Engineering Management

Unit Code: **F/651/0809**

Level: **5**

Credits: **15**

Introduction

Engineers are professionals who can design, develop, manufacture, construct, operate, and maintain the physical infrastructure and content of the world we live in. They do this by using their academic knowledge and practical experience, in a safe, effective, and sustainable manner, even when faced with a high degree of technical complexity.

The aim of this unit is to continue building up on the knowledge gained in *Unit 4004: Managing a Professional Engineering Project* or *Unit 4062 Professional Engineering Practice*, to provide students with the professional standards for engineers and to guide them on how to develop the range of employability skills needed by professional engineers.

Among the topics included in this unit are: engineering strategy and services delivery planning, the role of sustainability, Total Quality Management (TQM), engineering management tools, managing people, and becoming a professional engineer.

On successful completion of this unit, students will be able to construct a coherent engineering services delivery plan to meet the requirements of a sector-specific organisation or business. They will display a personal commitment to professional standards and obligations to society, the engineering/manufacturing profession, and the environment.

This unit is assessed by a Pearson-set theme. The project brief will be set by the centre, based on a theme provided by Pearson (this will change annually). The theme and chosen project within the theme will enable students to explore and examine a relevant and current topical aspect of professional engineering/manufacturing sector.

***Please refer to the accompanying Pearson-set The Guide and the Theme Release document for further support and guidance on the delivery of the Pearson-set unit.**

Learning Outcomes

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

LO1 Evaluate risk management theories and practices employed in engineering/manufacturing projects

LO2 Produce an engineering/manufacturing services delivery plan that meets the requirements of a sector-specific organisation

LO3 Develop effective leadership, individual and group communication skills

LO4 Demonstrate personal commitment to professional standards and obligations to society, the engineering profession, and the environment.

Essential Content

LO1 **Evaluate risk management theories and practices employed in engineering/manufacturing projects**

The engineering/manufacturing business environment:

Organisational structures and functional elements

Strategic planning and deployment

Engineering strategy and services delivery planning

The role of sustainability and environmental efficiency in decision making

Total Quality Management (TQM)

Logistics and supply chain management

Financial data, information, storage, and data management systems

New product development strategies

Legal obligations and corporate responsibility.

Risk evaluation in engineering/manufacturing projects:

Overview of risk analysis, assessment, and management

Key theories, methods, and applications (e.g., machinery, manufacturing, power plants, supply chains, etc.)

Case studies – example uses of Decision Tree Analysis, What If Analysis, Event Tree Analysis, Fault Tree Analysis

Risk governance, safety, data sources, risk-informed decision-making, standards (e.g. ISO 31000: Risk management), security, and life-cycle use of risk.

Engineering relationships:

The relationship between engineering and financial management, marketing, purchasing, quality assurance, and public relations.

LO2 **Produce an engineering/manufacturing services delivery plan that meets the requirements of a sector-specific organisation**

Management tools/software for engineering/manufacturing sector:

Problem analysis and decision-making, change management, performance management, product and process improvement, scheduling matrix, project management (including use of tools/techniques e.g. SWOT (strengths, weaknesses, opportunities, threats) analysis, stakeholder matrices, risk mapping, radar charts and summary risk profiles), and earned value analysis.

Services Delivery Plan:

Detailed task breakdown

Challenges–Planned and unforeseen

Internal and external influence

Impact on other services/users/stakeholders

Cost implications

Responsibilities.

LO3 **Develop effective leadership, individual, and group communication skills**

Managing people:

Describe the most effective leadership styles

Techniques to effectively manage teams (e.g., clear vision, systematic, transparent, delegation, collaboration remote working, etc.)

Individual/team CPD with opportunities for upskilling/reskilling (e.g., digital competencies and sustainability goals/frameworks) and ownership

Impact of effectively managing people

Motivation theories

Coaching and mentoring.

Steps to follow for leading effective meetings and delivering effective presentations:

Meeting management skills

Communication skills: Listening, non-verbal communication, clarity and brevity, friendliness, confidence, empathy, open-mindedness, respect, feedback, and picking the right medium

Communication with groups: Group expectations; communication formats (e.g. written reports, verbal, electronic, social media, data metrics); dealing with reactions and disagreements; allowing and encouraging participation; acting on agreed outcomes; negative communication; motivating disillusioned colleagues; persuasion and negotiation

Human error evaluation

Coaching and mentoring.

Workplace considerations:

Human factors (organisational, environmental, and job factors), influence and impact individual characteristics, performance, and behaviours in the workplace

Systematic and proactive approach to problem-solving

Safety-first culture, policies and procedures, and compliance with legislative and organisation health, safety, and environmental requirements

Equality and diversity: Ensuring work produced and the approach to work is inclusive and takes proper, account of equality of opportunity and the diverse nature of the population.

LO4 **Demonstrate personal commitment to professional standards and obligations to society, the engineering profession, and the environment**

Becoming a professional engineer:

Engineering social responsibility

Importance of being active and up to date with the engineering profession, new developments and discoveries

Methods of Continuing Professional Development (CPD). Work ethics: positive, professional, respectful, trusting, and ethical working relationships. Lead by example. Holistic stakeholder engagement. Ownership of professional development and up-to-date with subject/sector developments (e.g., digital competencies, sustainability goals/frameworks).

Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
LO1 Evaluate risk management theories and practices employed in engineering/manufacturing projects		
P1 Discuss any two risk evaluation theories associated with the management of engineering/ manufacturing projects. **P2** Evaluate risk assessment methods and practices that impact the successful management of engineering/ manufacturing activities.	**M1** Analyse the application of risk management theories for a given engineering/ manufacturing context.	**D1** Critically evaluate the challenges encountered when meeting the requirements for successfully managing engineering activities, with justified recommendations to overcome these challenges.
LO2 Produce an engineering/manufacturing services delivery plan that meets the requirements of a sector-specific organisation		
P3 Produce an engineering services delivery plan, applying the appropriate sector-specific requirements. **P4** Determine the engineering management tools needed for designing an engineering/ manufacturing services delivery plan.	**M2** Evaluate how each step of the delivery plan developed meets the requirements of a sector-specific organisation.	**D2** Critically evaluate contingencies that might prevent the delivery plan from meeting the requirements of a sector-specific organisation.

Pass	Merit	Distinction
LO3 Develop effective leadership, individual and group communication skills		
P5 Develop the steps for effective persuasion and negotiation. **P6** Explain the steps for managing effective group meetings. **P7** Outline the steps to deliver an effective presentation.	**M3** Evaluate leadership styles and effective communication skills using specific examples in an organisational context.	**D3** Critically evaluate effective ways to coach and mentor disillusioned colleagues or a poorly performing team.
LO4 Demonstrate personal commitment to professional standards and obligations to society, the engineering profession, and the environment		
P8 Examine the context of social responsibility for scientists and engineers. **P9** Demonstrate the ways by which an engineer can engage in continuing professional development.	**M4** Summarise the engineering profession's ethical standards and patterns of behaviour.	**D4** Provide justifications as to why it is necessary to be active and up to date with the engineering profession's new developments and discoveries.

Recommended Resources

Note: See HN Global for guidance on additional resources.

Print Resources

Bahr N.J. (2015) *System Safety Engineering and Risk Assessment – A Practical Approach*. Second Edition. CRC Press

Burns, B. (2014) *Managing Change*. 6th Ed. Pearson.

Challender J. (2022) *Professional Ethics in Construction and Engineering.* Wiley.

Covello V.T. (2021) *Communicating in Risk, Crisis, and High Stress Situations: Evidence-Based Strategies and Practice*. Wiley.

Dearden, H. (2013) *Professional Engineering Practice: Reflections on the Role of the Professional Engineer.* CreateSpace Independent Publishing Platform.

El-Reedy M.A. (2021) *Offshore Projects and Engineering Management*. 1st Edition. Elsevier.

Karten, N. (2010) *Presentation Skills for Technical Professionals*. IT Governance Ltd.

Kerzner H. (2022) *Project Management: A Systems Approach to Planning, Scheduling, and Controlling.* 13th Edition, Wiley.

Kiran D.R. (2022) *Principles of Economics and Management for Manufacturing Engineering.* Elsevier.

Kong K. (2019) *Professional Discourse.* Cambridge University Press.

Lock, D. (2013) *Project Management*. 10th Ed. Routledge.

Muzio D., Sundeep A. and Kirkpatrick I. (2020) *Professional Occupations and Organizations.* Cambridge University Press.

Rausand M. and Stein Haugen S. (2020) *Risk Assessment: Theory, Methods, and Applications*. John Wiley & Sons, Inc.

Temple T.J. and Ladyman M.K. (2022) *Challenges in Risk Analysis for Science and Engineering*. IOP Publishing Ltd.

Wilbers S. (2022) *Persuasive Communication for Science and Technology Leaders: Writing and Speaking with Confidence*. Wiley.

Wright I. (2012) *Risk Evaluation (Engineering Design Book 1)*. Kindle Edition.

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.

Advanced Engineering Informatics

Advances in Engineering Software

Applications in Engineering Science

Control Engineering Practice

Cleaner Engineering and Technology

Engineering

Engineering Applications of Artificial Intelligence

Engineering Management

Engineering Management Journal

Frontiers of Engineering Management

IEEE Transactions on Engineering Management

Journal of Engineering and Technology Management

Journal of Management & Organization

Journal of Professional Issues in Engineering Education and Practice

Microelectronic Engineering

Probability in the Engineering and Information Sciences

Probabilistic Engineering Mechanics

Results in Engineering

Links

This unit links to the following related units:

Unit 4004: Managing a Professional Engineering Project