ENGINEERING MANAGEMENT - 2024/5

Module code: ENG3169

Module Overview

This module addresses engineering management in terms of informed decision making, based on technical, quality, commercial and legal requirements. Engineering activities are considered in the context of complex projects, organisational structures and economic/societal/legal/ethical constraints. Modern approaches for efficient and informed decision making are introduced, including the use of advanced project management, systems engineering, uncertainty management, quality management, systems security, company accounting, project evaluation and the management of intellectual property. Legal requirements, associated with managing risk and safety, are considered. The module hence provides key insights and knowledge in preparation for working in a professional engineering environment.

Module provider

Mechanical Engineering Sciences

Module Leader

BAKER Mark (Mech Eng Sci)

Number of Credits: 15

ECTS Credits: 7.5

Framework: FHEQ Level 6

Module cap (Maximum number of students): N/A

Overall student workload

Independent Learning Hours: 76

Lecture Hours: 26

Tutorial Hours: 11

Guided Learning: 11

Captured Content: 26

Module Availability

Semester 2

Prerequisites / Co-requisites

N/A

Module content

Indicative content includes:

Advanced Project Management

- Networking methods, Activity on Arrow, Activity on Node, Critical Path Analysis, Total/Free Float
- Time-limited and Resource-limited project planning, Resource Levelling
- Organisational Structures, Impact of Organisation on Projects

Uncertainty Management and Risk

- Quantifying uncertainty, Pessimistic-Likely-Optimistic, Central Limit Theorem
- Project duration based examples, PERT, Event Probabilities
- Quantitative/qualitative risk assessment
- IT security

Systems Engineering

- Systems Approach, Requirements Analysis, Functional Breakdown, Physical Breakdown, System Architecture, Verification and Validation
- Systems security

Organisation and Financing of Companies

- Types of business, elements of company law, sources of funding, classes and types of shares, share transactions, FTSE100 and other indices.
- The business environment, company ethos and structure, economies of scale.

Introduction to Management Accounting

- Basic accounting concepts, interpretation of accounts, ratio analysis.

The Company in Business

- Company structure, elements of product cost, manufacturing costs, general costs, fixed, variable and marginal costs, cost behaviour, marginal costing, break-even analysis, profit sensitivity analysis.

Project Evaluation

- Return on capital, payback time, discounting and net present value, comparison of alternatives, risk and uncertainty in investment. Environmental impact and project sustainability.

Project sustainability analysis

- Introduction to Design for Environment (DfE), Quantitative tools and standards for environmental impact assessment (Life cycle Assessment (LCA), Carbon footprinting), case studies in environmental impact assessment, Introduction to concepts in Corporate Social Responsibility (CSR)

Quality Management

- The ISO 9000 eight quality principles, ISO 9001- its context and value to the business.
- Quality tools – affinity diagrams, process maps, fishbone diagrams, SWOT analysis.
- Quality methods – Deming Cycle, Sigma Six, Statistical process control, Kaisen, Lean Manufacturing.

Intellectual Property & Patents

- Different classes of intellectual property, national and international context, patent application process, non-disclosure agreement, value of intellectual property in business.

Industrial Legislation

- Working Environment, Health and Safety

- Identification, quantification and control of hazards/risks
- Need for high professional & ethical conduct

Assessment pattern

Assessment type	Unit of assessment	Weighting
Coursework	COURSEWORK	30
Examination	2HR INVIGILATED EXAMINATION	70

Alternative Assessment

N/A

Assessment Strategy

The assessment strategy is designed to provide students with the opportunity to demonstrate understanding of engineering management aims/constraints and the application of methods to inform associated decision making. The coursework allows students to demonstrate that they can use advanced project management techniques to predict project schedules, including the ability to manage uncertainty. It also allows demonstration of systems thinking during the initial definition of a project, by addressing a top-level project requirement and presenting a clear breakdown of the resulting requirements and solution architecture. The exam allows students to demonstrate understanding of organisational, commercial, quality and intellectual property aspects, together with application of financial assessment methods.

Thus, the summative assessment for this module consists of:

- Coursework [Learning outcomes 1,2,3,4,5]
- Examination [Learning outcomes 1,6,7,8,9]

Formative assessment and feedback

- Formative verbal feedback is given in tutorials
- Written feedback is given on the coursework

Module aims

- A critical understanding of how engineering management depends upon informed and ethical decision making, encompassing technical, quality, commercial and legal requirements and sustainable development and corporate social responsibility
- An introduction to modern approaches for efficient management of engineering based activities, particularly associated with development of complex engineered systems
- The ability to apply advanced project management techniques, including application of systems engineering and uncertainty/risk management
- An introduction to various organisational models and the impact on project/business operations
- An introduction to quality management, company accounting and financing, cost analysis, project evaluation and the management of intellectual property
- A framework for personal and corporate professional and ethical behaviour,

Learning outcomes

Ref		Attributes Developed	
001	Demonstrate a clear understanding of how engineering management involves balancing technical, commercial, ethical, security and legal considerations	KP	C5, C/M8, C/M10, C/M15
002	Apply advanced project management techniques, such as critical path analysis, resource levelling and uncertainty management, to ensure projects reach a satisfactory conclusion	KCPT	C/M6
003	Apply a systems approach for requirements capture and system concept design, deriving separate functional and physical architectures	KCPT	C/M6
004	Show awareness of legal requirements governing engineering activities, the working environment, safety and the management of risk	KP	C/M9, C/M10
005	Show awareness of how projects can be evaluated in the context of sustainable development, environment impact and corporate social responsibility	KCPT	C5,C7
006	Show awareness of the need for ethical standards when working in a professional engineering environment	KPT	C/M8
007	Describe alternative company structures, with associated operations and practices	K	C/M15
008	Evaluate the financial status of projects or companies, in the context of life cycle analysis and commercial risk	KCPT	C7,C/M9
009	Demonstrate a clear understanding of the importance of quality in all aspects of engineering	KPT	C14,C15, M14, M15
010	Demonstrate a clear understanding of the importance and use of intellectual property	KP	C15, M15

Attributes Developed

C - Cognitive/analytical

K - Subject knowledge

T - Transferable skills

P - Professional/Practical skills

Methods of Teaching / Learning

The learning and teaching strategy is designed to:

introduce the key aspects of engineering management, through theory, reference to standards, real world cases and worked examples. This is delivered through lectures and tutorial classes, feeding into a large coursework assignment and final exam.

The learning and teaching methods include:

- lectures (including some pre-recorded content)
- tutorials (in groups)
- Project and Systems Engineering Coursework

Indicated Lecture Hours (which may also include seminars, tutorials, workshops and other contact time) are approximate and may include in-class tests where one or more of these are an assessment on the module. In-class tests are scheduled/organised separately to taught content and will be published on to student personal timetables, where they apply to taken modules, as soon as they are finalised by central administration. This will usually be after the initial publication of the teaching timetable for the relevant semester.

Reading list

https://readinglists.surrey.ac.uk
Upon accessing the reading list, please search for the module using the module code: ENG3169

Other information

The School of Mechanical Engineering Sciences is committed to developing graduates with strengths in Employability, Digital Capabilities, Global and Cultural Capabilities, Sustainability and Resourcefulness and Resilience. This module is designed to allow students to develop knowledge, skills and capabilities in the following areas:

Employability: This module will prepare students for the workplace in the following ways. Students are introduced to the financing of companies, projects and understanding company annual accounting statements. This enables them to appreciate the importance and role of shareholders and bondholders, profitability, cost control, cost projections etc. in any engineering business. Generic ISO9001 quality management principles and quality monitoring tools are described in lectures and tutorials, representing important knowledge for new employees in any company, but particularly manufacturing companies. Project and system management processes are taught, knowledge of which is very important for larger engineering companies and engineering consultancies.

Digital Capabilities: In the project management part of the module, digital creation, problem-solving and innovation are required to plan projects and understand the critical paths and key areas of uncertainty within a complex project, underpinning their future use of such computational tools. Innovation methodologies in the form of the systems engineering philosophy and ideation/design synthesis process can be applied to design or digital field. The systems engineering problems are also electro-mechanical systems which invariably have software and digital processing elements to them, important in preparing students for their use in a commercial environment. On the digital communication theme, some of the safety case studies (e.g. challenger or piper alpha disasters) emphasise the importance of robust digital systems for record keeping and communication.

Global and cultural responsibilities: In the Sustainability part of the module, students will become aware of the global issues surrounding global warming, finite natural resources, sustainable manufacturing and the contribution all organisations and individuals need to make to ensure future sustainability for all. The ethical responsibility of engineers and engineering organisations, in the form of professional practice as stated by the Engineering Council is also covered in the module. The five classes of intellectual property are introduced to the students. Their responsibilities in abiding by the legal principles of intellectual property in addition to the benefits gained from using intellectual property to protect their ideas and products are made clear.

Sustainability: Many important sustainability topics are taught to the students in five specific lectures on sustainability. The topics include life cycle analysis (concepts, methodology, standards, examples), corporate social responsibility and corporate environmental management, risk assessment, ethical motives for environmental protection and system analysis tools for climate change mitigation and adaptation.

Resourcefulness and Resilience: In the Quality Management tutorials, the students work in groups to determine the technical problems with a manufactured machine based on customer feedback, sharing ideas, engineering knowledge and experience, developing resourcefulness. In the Project Management coursework, the students have to be resourceful, resilient and creative in individually solving problems set on project scheduling, risk analysis and a systems engineering hypothetical scenario. In the tutorial on intellectual property, resourcefulness is required to identify the maximum intellectual property benefit for a new product introduced to the marketplace.

Programmes this module appears in

Programme	Semester	Classification	Qualifying conditions
Aerospace Engineering BEng (Hons)	2	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Aerospace Engineering MEng	2	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Automotive Engineering (Dual degree with HIT) BEng (Hons)	2	Optional	A weighted aggregate mark of 40% is required to pass the module
Automotive Engineering BEng (Hons)	2	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Automotive Engineering MEng	2	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Biomedical Engineering BEng (Hons)	2	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Biomedical Engineering MEng	2	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Mechanical Engineering BEng (Hons)	2	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Mechanical Engineering MEng	2	Compulsory	A weighted aggregate mark of 40% is required to pass the module