

MEng Automotive Engineering

UCAS code	H337
Institution code	H12
Duration	5 years (full-time) including a one-year work placement. A four year programme is available for applicants with at least two years, full-time relevant work experience.
Start date	September 2023
Accredited by	Institution of Agricultural Engineers (IAgrE)
Location	Harper Adams University campus (and location of work placement)*

The course

Automotive Engineering is a dynamic and expanding branch of engineering challenged to develop efficient, safe and environmentally sustainable vehicles that meet the needs of a growing and more mobile global population.

Our course addresses the breadth of vehicle technologies and application with an additional focus on the off-highway vehicle sector which ranges from sports utility vehicles, to construction equipment, to defence vehicles, each of which produces further challenges to the automotive engineer.

Students will learn about on-road vehicle systems and technologies plus specialist modules will ready our engineers for the additional challenges of the off-highway sector. You will develop your knowledge and engineering skills through contextualised modules and using specialist facilities such as our Soil Hall, Off-road Track, Applied Engineering Workshop and laboratories. There is a wide range of on and off-highway vehicles available for students to use as part of project work and there are also opportunities to get involved with cutting-edge research in autonomous and connected vehicles with Harper Adams' Hands Free Farm.

You won't have to wait to put your learning into practice – you will be a member of a team of engineers from day one engaged with real-world scenarios and projects. Assessment typically includes live industry projects, creating and exhibiting new products, creative portfolios, and applying specialist engineering tools and techniques.

Supported by an integrated placement year in industry, you will be primed for your future career using personal, technical and professional skills employers have identified with us as critical to your graduate employability in roles such as researching, designing and testing the next generation of vehicles and vehicle systems.

Duration

5 years (full-time) including a one-year work placement. A four year programme is available for applicants with at least two years, full-time relevant work experience. Please contact <u>Admissions</u> for further information on this option.

A-level entry requirements

- A2 level grades **AAB** including A2 Mathematics
- Offers tend to be in the region of **136** UCAS points
- Mathematics is mandatory, the following subjects are also preferred; Physics, Biology, Chemistry, Further Mathematics, Design Technology
- General Studies and Critical Thinking are encouraged but **not** included in grades required
- Overseas applicants please check our <u>English Language Requirements</u>
- Applicants can expect to receive offers including specific grades in specific subjects (for example, a B or C at A level, or an M or D for BTEC modules)
- Key Skills (and other level 2 variants) and First Certificates/Diplomas are not accepted in place of GCSE passes
- 4 GCSEs at grade C/4 or above, including English Language, Maths and a Science

Note: Entry Requirements are for guidance only, please check the UCAS website or contact Admissions for further information.

Work placement

Students spend their 12-month placement with companies such as Jaguar Land Rover, Terex, JCB, Caterpillar, and BAE Systems. Past experience shows many students find graduate employment with their placement company.

You will be helped to find the right role by an engineering placement manager based at Harper Adams.

Accreditation



This course is accredited by the Institution of Agricultural Engineers (IAgrE), and MEng graduates are eligible for initial registration for Chartered Engineering status. The Institution of Mechanical Engineers (IMechE) describes an Incorporated Engineer as an applications-based engineer who works with the technology that is available, while a Chartered Engineer specialises in analysis, creating the technology of tomorrow.

Careers

Career opportunities in the Automotive sector are outstanding. Our graduates are highly sought-after for their technical knowledge and skills but also their soft skills, essential in a modern engineering environment. MEng students will typically go on to work in design, development and technical specialist/consultant roles, managing engineering teams, providing technical or senior management leadership, or start their own businesses. Past students have gained employment in multinational manufacturers including Jaguar Land Rover, JCB, Caterpillar and BAE Systems, engineering support services such as HORIBA MIRA and Prodrive but also small highly specialist companies such as Supacat, Niftylift and Rail-Ability.

What will I study?

Year 1		Year 2		Year 3	Year 4		Year 5	
The Professional Engineer (E4004HF)	20	DMAIC	20	Placement year	Ethics and sustainability	10	Masters Engineering Project	60
Materials (E4005HF)	20	Design and Validation	20		Power Hydraulic Systems	10	Emerging Technologies	20
Problem Solving (E4003HF)	10	Integrated Electronic Systems	10		Group Project C23	20	Managing New Product Development	20
Electronics, Microcontrollers and Programming	10	Vehicle Systems	20		Vehicle Dynamics & NVH	20	Future Vehicle Systems	20
(E4002HF) Actuation (E4001HF)	20	Off Highway Vehicle Mobility & Vehicle Testing	20		Power Systems C23	20		
Measurement	20	Mechanical Science 2	20		Engineering Management & Leadership	20		
		Elective			Professional			
Mechanical Science 1 (E4006HF)	20	Agri-Tech	10		Engineering Research	20		
		Autonomous	10					

Autonomous Systems

The Professional Engineer

1

Y	ear	of	stu	dv
		-		

Code	E4004HF
Credits	20
Core/option	Core

Overview of Module:

Engineering relies on three core elements, namely scientific principles, mathematics, and realisation. Scientific principles underpin all engineering, while mathematics is the language used to communicate parameters and to model and optimise solutions. Realisation encapsulates the whole range of creative abilities which distinguish the engineer from the scientist: to conceive, make and actually bring to fruition something which has never existed before - and to create intellectual property, associating invention with commercial or social value. It is, therefore, incumbent on Professional Engineers to develop solutions responsibly – and the ability to develop economically viable and ethically sound sustainable solutions is an essential and distinguishing characteristic of engineering. In this module, you will:

- Explore the required qualities and requirements of becoming a professional engineer, as well as the range of roles and industries available within the Agricultural, Automotive and Mechanical Engineering sectors. You will use this to inform your early career planning andselection of specialist routefrom Year 2.
- Develop your study skills, giving you the tools to help your transition into Higher Education and to build your confidence in information literacy, research and independent learning.
- Learn and apply a range of communication methods including presentations, 3D Solid Modelling, Technical Drawing.
- Be guided through the production of an exemplar case study portfolio, where you follow a defined process to develop an engineered solution to a constrained mechanical problem and thus gaining experience as to how the various elements that you study on your degree combine to give

you the capability to reliably engineer solutions to given problems.

Materials

Year of study	1
Code	E4005HF
Credits	20
Core/option	Core

Overview of Module:

Materials, processing and design are three fundamental engineering disciplines which must be considered together at the start of the design process; it is not possible to design without understanding materials and the way in which they can be shaped and their properties modified.

This module intends to give you a fundamental knowledge of materials, properties and processing techniques and, overall, aims to equip you with the knowledge and confidence to successfully select the most appropriate material for an application as well as understanding how it may be made. Up-to-date materials selection tools and software will be used.

It is important to recognise that materials are a finite resource. Therefore, sustainability and supply will also be major themes.

This module will follow a design led approach and will be structured around case studies and applications. Practical activities will be included to demonstrate properties and processes.

This module also serves to support you with the selection and use of information and literature, so one of the assessment points will be a literature review.

Intended Learning Outcomes:

Students who successfully complete this module will be able to:

Differentiate between the key design limiting properties of typical engineering materials. Explain fundamental material processing and joining techniques and where their use may be appropriate.

Propose, select and justify appropriate materials and processes for given applications. Evaluate information about materials supply challenges.

Problem Solving

 Year of study
 1

 Code
 E4003HF

 Credits
 10

 Core/option
 Core

Overview of Module:

This module will introduce you to **how** to approach tackling unfamiliar problems and **why** engineers follow a systematic approach in order to reliably and repeatedly tackle complex problems. It will ensure that you can practice a range of problem-solving methodologies, tools and techniques. Through a series of practical problem solving activities, you will develop discipline in undertaking a structured approach. This will be a hand on applied process to train you into thinking and behaving as a professional engineer.

Intended Learning Outcomes:

Students who successfully complete this module will be able to: Define a given problem with consideration for constraints, needs and options. Use industry standard methodologies to identify root cause for given problems. Use a structured approach to solution selection and implementation.

Electronics, Microcontrollers and Programming

Year of study1CodeE4002HFCredits10Core/optionCore

Overview of Module:

Electronic systems are key to modern engineering. You will learn the basics of electrical and electronic systems and programming of microcontrollers applied to real world engineering systems. Using appropriate theory and practice, you will design circuits, specify and select components and build circuits. Additionally, you will interface microcontrollers to components, and program them to complete a specific task.

You will learn through a mixture of lectures and tutorials, and practical classes where you will apply the theory and develop practical skills.

You will be assessed throughout the module by mini tests which will as inform you of your learning progress, but also by an end of module time constrained computer-based assessment. Additionally, to test your practical skills, you will design and manufacture a functioning circuit.

Intended Learning Outcomes:

Students who successfully complete this module will be able to:

Design circuits and select suitable components to meet a requirement. Interface a microcontroller to components to meet a requirement. Write a program for a microcontroller to meet a specific task. Build a physical circuit and test it against a specification

Actuation

Year of study	1
Code	E4001HF
Credits	20
Core/option	Core

Overview of Module:

This module is providing you with a thorough grounding in the development of mechanisms and technologies for actuation, for example, chain drives, hydraulics, levers, gears. This is the module that will take you from entrant with no or minimal experience of actuation technology to become experienced and be able to work confidently with actuation technology.

Through a range of teaching and learning techniques, such as lectures, tutorials, practicals, reading, the module will investigate the development of actuation science, methodologies and technologies relevant to agricultural, automotive and mechanical engineering disciplines. The module will be assessed using a blend of mini online tests and coursework, based on the application of actuation technologies relevant to your chosen engineering discipline.

Intended Learning Outcomes:

Students who successfully complete this module will be able to:

Design mechanisms to translate force, torque and velocity to meet given requirements.

Select the components required to satisfy the functional performance needs for a given actuation system.

Explain the operation of fundamental fluid power components and simple systems.

Measurement

Year of study1Credits20Core/optionCore

Overview of Module:

This module will show you that measurement is not a simple 'one off' activity but is professional engineering process. The module will develop your ability to use measurement equipment and to record and analyse measurement results. It will develop your ability to complete the whole process of designing, validating and conducting real engineering measurements.

Intended Learning Outcomes: (Typically between 3 and 5)xii

Students who successfully complete this module will be able to:

Report measurements using appropriate systems of units and explain their traceability.

Experimentally determine, analyse and report upon uncertainty of measurement.

Select and correctly deploy different types of measurement technology.

Design, conduct and validate an engineering measurement to achieve a specification.

Mechanical Science 1

Year of study1CodeE4006HFCredits20Core/optionCore

Overview of Module:

In this module you will be introduced to the connection between mathematical tools and techniques, accepted theories of mechanics and the use of software applications in the modelling, analysis and prediction of the behaviour of mechanical systems. These could be mechanisms, components of machines, or moving bodies, on any scale. It a uses a combination of approaches including practical, theoretical and software. A regular series of mini-tests will check your understanding and progress, with a larger applied problem-based assessment at the end. This module is essential to your understanding in a wide range of other subjects at this level and further on in your course.

Intended Learning Outcomes:

Students who successfully complete this module will be able to:

Recognise the value of theoretical methods to predict real-world behaviour of mechanical systems. Select and apply a range of mathematical techniques to solve static and dynamic problems. Use physical and software resources to investigate, analyse and communicate solutions to engineering scenarios.

Agri-Tech

Year of study2Credits10Core/optionCore

Overview of Module:

Mechanised agricultural is seeing a shift towardutilising Agri-Tech for data acquisition, management, insight and implementation ensure food production within planetary boundaries. You will beintroduced to key sensing and data tools commercially available to farms and explore how this is practically implemented through mechanisation and automation. You will engage with a range of subject experts from both academic and industry in a series of lectures, discussionsand practical demonstrations. You will propose an economically and agronomically viable Agri-Tech solution for a farm case study as the module assessment.

Intended Learning Outcomes:

Students who successfully complete this module will be able to:

Critically appraise the latest commercial precision farming technologies and their limitations. Review the findings of published research, in terms of potential implications for agriculture. Financially model farming technology for a specific application to assess its viability.

DMAIC

Year of study2Credits20Core/optionCore

Overview of Module:

Define, Measure, Analyse, Improve and Control, or DMAIC as it is widely known, is a data-driven improvement process used in all kinds of businesses, in projects and in design.

This module will provide you with the tools and methods to tackle problems and projects in a structured way through the aforementioned phases.

This module will incorporate aspects of measurement, experimentation, analysis, processes, productivity, quality, lean and waste.

Learning will be through a mixture of lectures and structured practical activities, and you will be assessed by a review, an experiment and a manufacturing scenario.

Intended Learning Outcomes:

Students who successfully complete this module will be able to:

Discuss the requirement for, and the impact of, a defined and data-led process for continuous improvement and problem solving.

Collect, process and assess the quality of data.

Select and apply appropriate analysis tools to a data set.

Propose and evaluate improvement and control plans.

Autonomous Systems

Year of study2Credits10Core/optionCore

Overview of Module:

Automated systems are found in all areas of the modern world.

You will learn the basics of automation including programming, electronics, mechanical systems and commercial applications.

Using appropriate theory and practice, you will design an automated system, specify and select components and demonstrate its functionality.

You will learn through a mixture of lectures, tutorials, and practical classes where you will apply the theory and develop practical skills.

You will be assessed by a group presentation, where you will investigate a commercial system, and to test your practical skills, you will design, manufacture, and demonstrate a functioning automated system.

Intended Learning Outcomes:(Typically between 3 and 5)

Students who successfully complete this module will be able to:

Appraise commercial automated systems Understand the components and control of automated systems Demonstrate the ability to implement an automated system

Design and Validation

Year of study2Credits20Core/optionCore

Overview of Module:xi

The design and validation involved in the engineering of a product is key to it's success. As well as the ability to rigorously apply engineering theory to an application, a professional engineer also needs a good understanding of the wider world in which their product will operate, and of the customer who will purchase it.

In this module you develop your professionalism and wider communication and teamworking skills, by following a structured design process to deliver a product that meets a customer brief.

You will design and validate a product from beginning to end, improving your capability in defining a problem, utilising specialist methodologies and techniques, working in a team, and liaising with customers and technical specialists.

This module will also provide the opportunity for self-reflection and professional development in preparation for your placement year, where applicable.

Intended Learning Outcomes: (Typically between 3 and 5)xii

Students who successfully complete this module will be able to:

Identify requirements and constraints within a client brief, in order to create a product design specification Engineera product to meet a product design specification

Develop a product to meet 'design for manufacture' and 'design for assembly' constraints.

Plan and execute a test, to evaluate a design against a product design specification

Reflect on feedback to guide the creation of a personal development plan for continuing professional development

Integrated Electronic Systems

Year of study2Credits10Core/optionCore

Overview of Module:

In many engineering solutions, there is a combination of electronic control systems and mechanical systems forming an integrated system. You will learn about electronic control, and the selection of sensors and actuators to form an integrated system whilst developing algorithms and associated programs to achieve a required function.

You will learn about integrating microcontroller systems through lectures covering the theory and tutorials to put the applications into perspective. Additionally, you will complete practical exercises on algorithm and program development.

You will be assessed by a series of mini tests throughout the module, and an end of module piece of coursework.

Intended Learning Outcomes:

Students who successfully complete this module will be able to: Select system components and integrate them into a control system. Develop and implement an algorithm for a control system to achieve a given task.

Vehicle Systems

Year of study2Credits20Core/optionCore

Overview of Module:

A complete functioning vehicle is actually a combination of individual systems and subsystems. In this module you will learn what systems industry typically breaks a vehicle down into. You will then look in more depth at each system, their function within a vehicle, their characteristics and specification, how they work, and any interactions with other system.

Your will learn through a series of lectures, tutorials and vehicle based practicals.

Throughout the module you will keep a portfolio of the tutorial and practical based activities which will form part of your assessment. Part way through the module you will have to produce an assessed presentation. Your final assessment will be a piece of coursework to demonstrate your deeper understanding of Vehicle Systems.

Intended Learning Outcomes:

Students who successfully complete this module will be able to:

Explain what the main systems are that make up a vehicle and interactions between them. Describe how vehicle systems work and explain how they meet vehicle requirements. Calculate vehicle and system parameters to meet vehicle requirements. Summarize the future global challenges affecting vehicle sustainability.

Off Highway Vehicle Mobility & Vehicle Testing

Year of study2Credits20Core/optionCore

Overview of Module:

Off highway mobility refers to how well a vehicle can travel over surfaces other than hard roads. During this module you will learn how vehicles interact with off road surfaces such as soil and rocks, how vehicle characteristics affect their mobility, and how terrain characteristics affect their trafficability. Vehicles need to operate all around the world, so you will learn about global factors affecting vehicle operation such as climate. You will also learn about other vehicle-soil interactions such as how construction machines break up/push/dig soil.

When designing and developing vehicles it is important to be able to measure their performance. You will learn about how to select suitable sensors for testing vehicle performance, interface them with computer-based data logging equipment, then collect and analyse data.

You will learn through a mixture of lectures and tutorials, and practical classes where you will apply the theory and develop practical skills.

Your first assessment will be by submitting a piece of coursework comparing independent research to practical test work. Your final assessment will be a time constrained applied assessment.

Intended Learning Outcomes:

Students who successfully complete this module will be able to:

Explain what vehicle characteristics affect vehicle mobility.

Explain what terrain properties affect trafficability.

Predict vehicle performance based on vehicle characteristics and terrain properties.

Select suitable instrumentation for measuring vehicle performance.

Mechanical Science 2

Year of study2Credits20Core/optionCore

Overview of Module:

In this module you will develop your knowledge of mechanical systems which will give you the ability perform more realistic modelling to bring the theoretical calculations much closer to those expected in practice. You will learn to analyse critical applications e.g. buckling theory; pressure vessels; fatigue failure, and determine dynamic behavioure.g; second order response; imbalanced dynamic forces; transmission of vibrations. A regular series of mini-tests will check your understanding and progress, with a larger applied problem-based assessment at the end. This module is essential to your understanding in a wide range of other subjects at this level and further on in your course. ?

Intended Learning Outcomes:

Students who successfully complete this module will be able to:

Apply knowledge of static and dynamic systems to evaluate a range of multi-factor mechanical

engineering problems.

Interpret quantitative data to determine the characteristics and response of mechanical systems. Solve a complexmechanical scenario through the selection and application of appropriate theoretical analysis and simulation methods and present a justified solution.

Placement year

Year of study 3 Core/option Core

Read our dedicated <u>Placement Learning</u> pages for information on the many benefits of the placement year.

Ethics and sustainability

Year of study4Credits10Core/optionCore

Overview of Module:

In order to be a complete professional engineer you will need to have a mature consideration of ethics and sustainability. The engineering council requires professional engineers to maintain and promote a high ethical standard and challenge unethical behaviour.

You will be shown how to construct and evaluate ethical arguments and you will be shown a wide variety of ethical issues in modern society. This will also develop your ability in ethical reasoning which is the ability to identify, assess, and develop ethical arguments from a variety of ethical positions. This will be developed during taught sessions where you will be encouraged to review and critically evaluate case studies and emerging ethical issues.

You will be encouraged to consider sustainability in its broadest sense – as applied to environment, business, design and society. This is of paramount importance as engineers must provide solutions that use energy and resources sustainably.

Intended Learning Outcomes: (Typically between 3 and 5)xii

Students who successfully complete this module will be able to:

Construct and evaluate ethical arguments in order to consider wider impact of decisions on society. Evaluate the environmental impact of decisions and business sustainability.

Apply the legal principles of intellectual property and the neighbour principle to product design and development.

Evaluate the ethical impact on business and sustainability of quality management systems and continuous improvement including product and material lifecycle and the circular economy. Evaluate the impact of security considerations from the international security to corporate data theft.

Power Hydraulic Systems

Year of study4Credits10Core/optionCore

Overview of Module:

Through your evaluation and simulation of applied complex hydraulic systems, you will develop specifications and select hydraulic components in relation to the function and operation of many agricultural and off-highway vehicles. Through a range of teaching and learning techniques, such as, lectures, tutorial, seminars, practicals, reading, the module will explore further applications of hydraulics in agricultural and off-highway systems for their function, operation and travel. The module will assess your learning and knowledge through a case study where you will evaluate and simulate hydraulic systems and specify suitable components to meet performance requirements.

Intended Learning Outcomes:

Students who successfully complete this module will be able to: Evaluate the operational requirements of hydraulic systems. Design and simulate complex hydraulic systems. Develop specifications and select hydraulic components to suit complex hydraulic applications.

Group Project C23

Year of study4Credits20Core/optionCore

Overview of Module:

Engineers are expected to be able to work effectively both independently and as a member of a team in the delivery of solutions to agreed standards and deadlines. Engineers, to be effective, must be able to study a given situation and be able to calculate delivery feasibility against time and resource availability. It is a lso a normal expectation that engineers are required to resolve complex problems in parallel to other work, and to work effectively with colleagues.

You will have gained group work experience in prior study and during the industrial placement period (or equivalent). This module aims to provide you with the opportunity to demonstrate your capability of working as a member of a project team having joint and several responsibility for the delivery of the project, and to demonstrate, in an applied context: an appropriate depth and breadth of technical knowledge and management capability; professional engineering behaviours; and an understanding of project delivery risks.

Each group project is generally sourced from companies within the engineering industry - companies typically provide background information, details of the problem, and some references for the team at the outset. Project deliverables and success criteria will be negotiated between client and team early in the project.

Intended Learning Outcomes:

Students who successfully complete this module will be able to: Devise, negotiate and agree deliverables in response to a given project. Plan and manage the delivery of a programme of workto deliver stakeholder value. Conclude the delivery of project deliverables in relation to stakeholder satisfaction Appraise personal and team performance

Vehicle Dynamics & NVH

Year of study4Credits20Core/optionCore

Overview of Module:

Vehicle Dynamics is the term given to how a vehicle handles and absorbs road irregularities. You will learn how steering and suspension systems and other vehicle properties influence a vehicle's ability to run in a straight line or corner predictably. Additionally, you will learn how the suspension can be designed and tuned to improve passenger comfort when the vehicle is travelling over irregular surfaces. NVH is a common term used in the automotive industry, and stand for noise, vibration and harshness. You will learn what causes NVH and how it can be reduced or attenuated to improve vehicle refinement, and so passenger comfort.

You will learn through a mixture of lectures to learn the theory, tutorials to reinforce the theory and put its application into perspective, and computer modelling based practicals to explore further the effects of changing vehicle parameters.

For the first assessment you will create a suspension design to meet target requirements. The assessment will be based on a presentation of the design. The final assessment will be by coursework covering the performance analysis and improvement of a vehicle dynamics and NVH system.

Intended Learning Outcomes:

Students who successfully complete this module will be able to:Interpret vehicle dynamics & NVH targets.Apply theory to analyse the effects of technologies on vehicle dynamics & NVH.Develop appropriate systems to meet vehicle dynamics targets.

Analyse vehicle dynamics and NVH data to assess performance and then suggest improvements.

Power Systems C23

Year of study4Credits20Core/optionCore

Overview of Module:

Vehicles both on road and off road have multiple complex systems for storing energy, producing power and transmitting power to different functions on the vehicle. Building upon previous knowledge, you will develop a deeper understanding of how power can be generated and transmitted.

Using vehicles available at Harper and real-world examples, you will analyse duty cycles to identify power flow for a particular task. Following on from this, you will propose suitable power sources and transmission systems to balance work capacity and efficiency targets.

You will learn through a series of lectures and tutorials covering theory and applications of power systems, and computer practicals to develop your modelling and analysis skills. There will also be practical demonstrations to help reinforce your theoretical and application knowledge. There will also be an expectation that you will do independent research to increase and demonstrate your depth of knowledge as part of coursework.

You will undertake two assessments, one covering a vehicle/machine duty cycle, analysing the energy and power flow, and a final assessment investigating and proposing energy efficiency improvements for the given duty cycle.

Intended Learning Outcomes:

Students who successfully complete this module will be able to:

Analyse the dutycycle for a mobile machine to establish the power flow to individual functions. Explain the characteristic and suitability of a range of power sources and transmission systems for given application.

Evaluate a range of power sources and transmission systems for a given application and make recommendations for optimising the performance and efficiency.

Select and apply appropriate modelling tools for the analysis and evaluation of performance.

Engineering Management & Leadership

Year of study4Credits20Core/optionCore

Overview of Module:

Engineers have a leading role in society and industry. Development of key management skills is an essential precursor to successful leadership of projects, operations and service delivery in the roles to which engineers are recruited. Critical to improvement of operational and service delivery outcomes is the ability to define, plan and lead change in complex organisations. This module will establish your mastery in the fundamentals of managing and leadingbusiness improvementthrough;

- Evaluation of those characteristics of individuals and businesses that drive performance
- Development of compelling improvement rationales and powerful communication approaches
- Synthesis of comprehensive change management strategies and development of influential leadership approaches.

In order to develop your leadership, at both a strategic and individual level, you will explore theories of

motivation, methodologies for deployment of objectives and tactics for identification and management of barriers to progress. Furthermore, through the understanding of change management theory and organisational behaviour, you will be prepared to plan for and to deliver successful business improvements in whatever environment you go on to pursue a graduate career.

Intended Learning Outcomes:

Students who successfully complete this module will be able to:

- 1. Evaluate the key characteristics of individuals and organisations pertaining to business performance.
- 2. Conduct a critical analysis of business output metrics in order to evaluate improvement opportunities.
- 3. Formulate and communicate a persuasive and impactful proposal for a business performance improvement.
- 4. Develop an effective change management strategy and deployment mechanism for the delivery of a business improvement.

Professional Engineering Research

Year of study4Credits20Core/optionCore

Overview of Module:xi

This module will allow you to develop your skills and knowledge in finding and defining a research question. It will also guide you through the process of selecting appropriate analyses methods and experimental design. You will be shown how to select the appropriate software for analysis and presentation of results according to the needs of your audience. The module will require you to independently tackle a small research question of your own choice but in a supervised and guided manner. This will involve conducting a supervised individual practical experiment to collect real world data. After this module you will have the skills and experience to tackle your Masters Engineering Project in your final year.

Intended Learning Outcomes: (Typically between 3 and 5)xii

Students who successfully complete this module will be able to:

Define the topic and scope for a research study using literature.

Select, evaluate, plan and conduct an experimental study with consideration of resources, software, statistical power and risk.

Analyse experimental data, interpret and present the resultsand write conclusions appropriately for a given audience.

Evaluate the reliability and validity of research

Masters Engineering Project

Year of study5Credits60Core/optionCore

Overview of Module:

The ability to resolve complex problems is a fundamental capability of a professional engineer.

Fundamental elements of this capability include: the intrinsic motivation and capability to identify, define and justify improvement opportunities; being able to define a problem; being able to select and correctly apply relevant tools, techniques, methods and practices in the resolution of the problem; and the ability to critically evaluate the effectivity of the applied process.

Successful completion of the Masters Engineering Project will demonstrate your motivation, resilience, and ability to work at the forefront of your chosen field of specialisation and contribute to the generation

of new knowledge. Your Masters Engineering Project functionally assesses in a holistic way your ability to engage with and deliver a successful body of work and as such forms the capstone activity for the curriculum.

Intended Learning Outcomes:(Typically between 3 and 5)

Students who successfully complete this module will be able to:

- 1. Select, justify and use appropriate tools and techniques to identify, define and constrain an improvement opportunity within their discipline.
- 2. Plan and utilise appropriate methods to ethically and sustainably deliver a solution to the identified improvement opportunity.
- 3. Conduct a technical evaluation of the project outcomes in relation to the satisfaction of the project requirements.
- 4. Conduct a reflective evaluation of the project outcomes in relation to the methods and practices adopted.
- 5. Present and defend project impact, conclusions and recommendations to a technical and non-technical audience

Emerging Technologies

Year of study5Credits20Core/optionCore

Overview of Module:

Given the dynamic nature of engineering and the engineering environment, it is important to ensure that engineers leadersare aware of new and developing technologies, subjects and industrial advances and appreciate the sociological, ethical, legal, economic, political, environmental, and managerial impact these will have in the future. This module is designed to ensure you have the skills to maintain contemporary knowledge throughout your careers and are aware of current key developments within engineering, industry and technology. Critically you will synthesise sources and opinions to evaluate wider social, economic, environmental, and ethical relevanceof these developments. You will develop awareness and understanding of a broad range of issues, initiatives and concepts particularly in areas of recent/ongoing research activity, through a mixture of keynote lectures, discussive tutorials and independent research.

Your assessment will be through technology sustainability review, firstly formatted as a journal style paper and then secondly presented as an engaging keynote talk as part of a module mini conference.

Intended Learning Outcomes:

Students who successfully complete this module will be able to:

Evaluate the consequences of recent advances in engineering upon the relevant industry.

Assess the potential impact of recent advances in engineering upon the wider environment.

Review the findings of published research in terms of their validity, reliability and implications for the future.

Synthesise evidence from a range of research and theoretical concepts to undertake a critical analysis of their impact upon the engineering industry.

Managing New Product Development

Year of study5Credits20Core/optionCore

Overview of Module:

For businesses to effectively use the various processes needed to take a product from customer demand through to manufacture, they must be managed. This module covers the various systems and controls

required to ensure that the correct processes are used at the right time.

The module will also provide you with the understanding of the problems associated with the management of new product development activities and staff, including metacognitive activities, behaviour management techniques, and personal awareness development. You will also apply the learning and develop formative understanding of your strengths, weaknesses, opportunities and threats (SWOT) and opportunities for personal development.

Intended Learning Outcomes:

Students who successfully complete this module will be able to:

1. Identify and plan resources required to support new product introduction and formulate a detailed project plan.

2. Identify and plan procedures and controls (design systems) to ensure successful introduction of a new product.

3.Critically evaluate the role of quality management systems, continuous improvement and risk management in the context of complex problems.

4. Critically evaluate the environmental and societal impact of solutions to complex problems (to include the entire life cycle of a product or process) and minimise adverse impacts.

5. Critically evaluate personal strengths and weaknesses with regard to the management of self and others.

Future Vehicle Systems

Year of study5Credits20Core/optionCore

Overview of Module:

Future vehicles need to have further improvement in sustainability and meet the changing demands of the users. In this module you will focus on two themes, sustainability and changing use of vehicles. Under sustainability you will further develop your knowledge of the application of electric drives and other emerging technologies relating to powering vehicles, but will also investigate other options to improve efficiency and support sustainability such as light weight structures and recyclability.You will also look at how future vehicle use is changing with the increased use of autonomy and interconnectivity, and changes in vehicle ownership models and expectations of safety.

Intended Learning Outcomes:

Students who successfully complete this module will be able to:

Propose and justify a potential solution to improve the sustainability of a specified vehicle/machine. Investigate, summeriseand hypothesize on a future global trend in relation to vehicle use.