University of Hertfordshire

PROFESSIONAL DEVELOPMENT AUDIT

Name

MSc Professional Engineering

Contents

Introduction

This report looks at the Definitive Module Document (DMD) for each of the modules in the University of Hertfordshire's MSc for Professional Engineering programme and translates them into work based projects. Salient information from each DMD is included at the start of each section for comparison with the proposed work content. As all of these projects are more biased to the field of Manufacturing Systems Engineering, information relative to other fields has been removed.

As the intention is to concurrently pursue Chartered status with the Institute of Engineering and Technology (IET) while completing these modules the relevant learning outcomes, as quoted in the DMD's, are also detailed. Included in the first section is a curriculum vitae style update of experience and qualifications to date.

The underlying intention is to develop self and company processes as the programme progresses. By undertaking this body of work, a better understanding of company operations will be gained. During the project, viable opportunities to exploit new and emerging technologies from outside of the industry will be researched. If these are found to be of Departmental benefit, details of their implementation will be reported.

Professional Development Audit (This Report)

Module Code: 3AAD0038

School of Aerospace, Automotive and Design Engineering

The module aims and learning outcomes are linked to the requirements of UK Spec as an initial audit of the candidate's academic competences.

Module Aims

- critically reflect, review, plan, monitor and take responsibility for their own learning and professional development within the context of meeting the requirements of UK Spec.
- improve their understanding of what, how and when they are learning and related study skills.

Intended Learning Outcomes:

Knowledge and Understanding

- understand the importance of professional development in the context of a rapidly changing environment.
- develop a comprehensive knowledge of the requirements of UK Spec in relation to their own background, knowledge and competences.

Skills and Attributes

- through reflection develop a critical awareness of competence shortfalls in the context of meeting UK Spec competences for professional registration.
- independently plan future career developments in the context of meeting UK Spec competences for professional registration.
- apply advanced planning and communications skills.

Generic Module

It is anticipated that candidates are seeking to gain Membership of a Professional Institution. In order to demonstrate the academic competences required for CEng registration it will be necessary for candidates to undertake an initial audit of their current formal qualifications and work based experience to identify gaps in relation to the requirements of UK Spec. The candidate will be required to develop, with input and the agreement of their supporting company, a programme of work based learning and study within a time plan that meets the aims, learning outcomes and duration described within the MSc in Professional Engineering programme specification.

A record of progress is to be maintained that is built into a learning contract, evidence and assessment performance. The academic competence audit, proposed learning contract and implementation plan will be appraised to ensure that it meets the aims and learning outcomes of the programme prior to authorisation to proceed via the Learning Contract Approval Board. Candidates will take this module at the beginning of their individual programme leading to the MSc in Professional Engineering. A tutor will be available to respond to candidate's queries (either by company visits, on-line or by telephone at specific periods) and candidates will be encouraged to form company and peer support. In order to support the programme and production of the Learning Contract students will be expected to undertake self study of the proscribed research methods and associated materials.

Assessment Details

This module is subject to 100% in course assessment and submissions should comprise of a proposed learning contract and implementation plan as a preparatory module for the MSc programme. Candidates will be required to demonstrate, via a well structured reflection of their academic competences and shortfalls, that they are able to assess their own learning and fully understand the principles underpinning UK Spec and the requirements of the MSc in Professional Engineering. The submission should comprise a report of approximately 5,000 words.

Purpose

The purpose of this module is to identify gaps in work experience and qualifications in relation to the UK Standard for Professional Engineering Competence [1] (UKSPEC). The output of this will be a self driven learning plan to fill these gaps and satisfy the competencies and qualifications required to gain membership of a professional institution. By benchmarking experience to date and qualifications gained against the UKSPEC the additional learning and progression required will be made apparent.

Career

Summary

Accomplished Engineer with more than ten years experience in the *Biotechnology sector (changed),* experienced in both people and project management.

Experience to date

After leaving school in 1956 with six "O" Levels, employment was gained with Metal Bashers as a Technician Apprentice. Upon successful completion of the requisite four and a half years covering aircraft design and manufacture, a permanent position as a *Technician* was taken in the Instrument Laboratory. Responsibilities included the manufacture, installation and calibration of instrumentation on *xxxx* development items pre flight instrument checks on these and production aircraft. Also achieved 150hrs test flight experience monitoring purpose built data acquisition systems.

The closure of *ZZZ company*, which commenced in *NNNN*, cut short an anticipated career with that company so a number of temporary contract positions followed. *<Confidential individual details removed>.*

Initially employed at < Soldering PLC> in a similar role to previous positions but now with responsibilities for the management of contract workers and a planned maintenance system. This role also provided the first in depth introduction to the heavily regulated industry that is <AAAA> manufacture. Major achievements include the successful validation of a <BBBB> plant and the development of preventative planned maintenance plans for product critical equipment.

Promoted to *Senior Technician in <date> and moved to a <XYZ>* department. Responsibilities included management of minor capital projects, day to day production issues, co-ordination of Engineering staff and deputising for the Packaging Engineering manager in his absence.

Assumed the role of *<DDDD> Engineering Manager in <Date>*. Increased responsibilities included the management of 16 multi-skilled staff across three

shifts, day to day production schedule adherence, departmental Health and Safety and staff training and development plans. Achievements included the installation of two <MMMM> lines, the successful introduction of three new products and management of both a departmental maintenance budget of £*<suppressed>* and capital spend on continuous improvement projects to within agreed limits

Although exposure to man management was extremely useful, a new challenge beckoned in 2002 in the shape of a Production Engineering role. The main responsibilities of the role were the costing and delivery of capital projects from specification to validation for a *<iphone>* department producing 27 million *<iphones>* per year. Lean Production and Six Sigma tools were used to implement continuous improvement projects devised to reduce process variability. During the five years spent in the role the major achievement was winning the *<knotting Award>* as part of a team working on a production capacity increase project that delivered a 20% increase in capacity, £6 million of recoveries against £50K capital spend, line OEE improvement between 66-150%, downtime reduction between 40-65% and Kaizen events leading to 30% changeover reduction.

Having completed a part time degree during the time spent working as a Production Engineer it was time to try to put some of this knowledge into use. In 2007, applied for and was selected as an *<door knob watcher>.* Working for the <*door knob designers>* was a first exposure to the earlier stages of the product development process. Responsibilities include the management and validation of injection mould tools and assembly equipment based at suppliers of *<door knob devices>.* Achievements so far include supplying equipment to mould, assemble and test Door Knobs.

Qualifications

1982: Engineering Industry Training Board First Year Training for Craftsmen and Technicians – <suppressed>.

1985: HNC Production Engineering – <suppressed>.

2005: BEng (Hons) Manufacturing Systems Engineering, <suppressed>.

Associate Member of Institute of Engineering & Technology

MSc in Professional Engineering Programme

The current educational requirements for Chartered status are an accredited Bachelors degree with honours plus an accredited or approved Masters degree [1]. By enrolling for the MSc in Professional Engineering at the University of Hertfordshire the aim is to obtain the necessary qualifications to address this shortfall. The objective is to simultaneously meet the needs of the work experience aspect of Chartered status by selecting suitable work based projects and aligning the module subject matter with the requirements of the UKSPEC.

Although career development is evident from the technician apprentice beginnings, it is recognised that personal knowledge and skills need to be constantly updated in light of new and advancing technology. The recent move to the *<suppressed>* has opened up opportunities to be involved in the decision making process on the function of *<suppressed>* and how they are manufactured. It has also meant an introduction to the field of plastic injection moulding, a subject only touched upon in the past. This steep learning curve should be some way alleviated by company sponsored courses scheduled to be attended in 2008.

As mentioned, *<suppressed>* devices are the focus of *<suppressed>* and the departmental responsibility covers initial design concepts right through to commercial scale manufacture. By targeting various aspects of this process it is anticipated that all the learning outcomes can be achieved.

The following sections of this report detail each module along with a proposed work based project that endeavours to cover the requirements of both the MSc in Professional Engineering and hence those of the UKSPEC. Below is a table detailing the chosen subject matter to satisfy each module and timings for their completion. Obviously, as these are work based modules and the plan covers three years, the running order and some of the timings may be subject to change.

		UK Spec Structure	Audit	Underpinning Science and Mathematics		Analysis and Design			Economic, Social and Environmental Context	Practice		
		Modules	Professional Development Audit – 3AAD0038	Scientific Principles and Technologies – MAAD0040	Mathematical and Computer Modelling Techniques – MAAD0041	Mathematical and Computer-based Problem Solving – MAAD0042	Design Processes and Methodologies – MAAD0043	New Technology and Design Innovation – MAAD0044	Management, Business Practices and Risk Management – MAAD0046	Technology Practice, Developments and Applications – MAAD0047	Individual Project - MAAD0045	**Accumulated Credit Points**
Credit Points			**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**60**	**180**
YEAR 1		Professional Development Audit	**15**									**15**
		Scientific Principles Applicable to the *<suppressed>*		**15**								**30**
		Modelling Techniques applied to *<suppressed>*			**15**	**15**						**60**

	UK Spec Structure	Audit	Underpinning Science and Mathematics		Analysis and Design			Economic, Social and Environmental Context	Practice		
	Modules	Professional Development Audit – 3AAD0038	Scientific Principles and Technologies – MAAD0040	Mathematical and Computer Modelling Techniques – MAAD0041	Mathematical and Computer-based Problem Solving – MAAD0042	Design Processes and Methodologies – MAAD0043	New Technology and Design Innovation – MAAD0044	Management, Business Practices and Risk Management – MAAD0046	Technology Practice, Developments and Applications – MAAD0047	Individual Project - MAAD0045	**Accumulated Credit Points**
Credit Points		**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**60**	**180**
YEAR 2	*<suppressed>* Device Development					**15**					**75**
	<suppressed> Design for Assembly						**15**				**90**
	A Quality by Design Approach to Device Development							**15**			**105**
	<suppressed> Filling and Assembly								**15**		**120**

	Equipment										

	UK Spec Structure	Audit	Underpinning Science and Mathematics		Analysis and Design			Economic, Social and Environmental Context	Practice		
	Modules	Professional Development Audit – 3AAD0038	Scientific Principles and Technologies – MAAD0040	Mathematical and Computer Modelling Techniques – MAAD0041	Mathematical and Computer-based Problem Solving – MAAD0042	Design Processes and Methodologies – MAAD0043	New Technology and Design Innovation – MAAD0044	Management, Business Practices and Risk Management – MAAD0046	Technology Practice, Developments and Applications – MAAD0047	Individual Project - MAAD0045	**Accumulated Credit Points**
Credit Points		**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**60**	**180**
FINAL YEAR	*<suppressed>* Commercial Scale Production									**60**	**180**

Scientific Principles and Technologies

Module Code: MAA0040

School of Aerospace, Automotive and Design Engineering

Institute of Engineering and Technology (IET) Learning Outcomes

The IET Handbook of Learning Outcomes [2] states Masters graduates may be characterised by the following attributes:

M1 – *"A comprehensive understanding of the scientific principles of own specialisation and related disciplines"*

M2 – *"An awareness of developing technologies related to own specialisation"*

Module Aims

- acquire a comprehensive understanding of the scientific principles of their own specialisation and related disciplines.
- demonstrate a comprehensive awareness of developing technologies related to their own specialisation

Intended Learning Outcomes

Knowledge and Understanding

- demonstrate an in depth knowledge of the scientific principles relevant to their own discipline.
- demonstrate a comprehensive awareness of scientific principles and their specific applications.

Skills and Attributes

- be able to critically evaluate alternative technologies and their applications.
- apply scientific principles to specific applications.
- identify relevant developing technologies and their potential applications.
- communicate complex technical information and analysis effectively.

Generic Module

Mechanical Engineering, Manufacturing Systems Engineering and Aeronautical Engineering

This module will focus on the understanding and application of scientific principles and technologies in the context of the student's engineering discipline and employment. Within the module, training and experience will be drawn from a range of topics, depending on the student's role within the company and on the company's activities.

Typical examples might be:

- application of existing scientific principles and technologies at a level appropriate to the particular discipline.
- the extension of existing techniques to use in new or innovative ways.
- derivation of new technologies appropriate to the particular discipline.

Actual Module Content

In order to satisfy the requirements of this module the proposal is to utilise the scientific principles and technologies currently being used to underpin the design intent for *<suppressed>* project.

Of the *<suppressed>* moulded components that make up the *<suppressed>* over half of them are still undergoing design changes. These changes can be due to optimisation of function or ease of manufacture and assembly. Each change requires evaluation with regards its effect on the pump's Critical Quality Attributes (CQA's) i.e. those attributes that every product must attain in order to meet the user requirements and specification. Therefore a programme of testing needs to be carried out so that a comparison of theoretical and actual data can take place.

The following is a list of some of the fundamental scientific principles that apply to the *<suppressed>* project

- Newton's Laws of Motion
- Circular Motion
- Forces, Energy and Work
- Properties of Materials
- Measurement of:
    - Flow
    - Pressure
    - Temperature
    - Position

- Force
- Velocity
- Acceleration

Although during previous education and experience these principles have been applied, the use of them in the design and manufacture of injection moulded plastic components is new territory. Obviously, it will not be possible to provide an in depth coverage of all of these but it is intended to focus on those that are key to the operation of the pump.

Assessment Details

In order to obtain 15 credit points towards the MSc in Professional Engineering this Work Based Learning (WBL) module is subject to a 100% in-course assessment. It will draw upon past and/or current experience through an approved programme of application and study.

The submission will comprise of a referenced submission of at least 5,000 words (or equivalent) and an accompanying portfolio of evidence.

The format and content of the portfolio will be dependent upon the work based learning context and evidence may typically include, but is not limited to:

- work evidence that demonstrates subject knowledge and skills.
- extended literature review covering the chosen scientific principle
- experimental results.

Mathematical and Computer Modelling Techniques

Module Code: MAA0041

School of Aerospace, Automotive and Design Engineering

IET Learning Outcomes

The IET Handbook of Learning Outcomes [2] states Masters graduates may be characterised by the following attributes:

M3 – *"A comprehensive knowledge and understanding of the mathematical and computer models relevant to the engineering discipline and an appreciation of their limitations"*

M4 – "An understanding of concepts from a range of areas including some outside engineering and the ability to apply them effectively in engineering projects"

Module Aims

- develop a comprehensive understanding of mathematical and computer models relevant to the specific discipline, and an appreciation of their limitations.
- gain an understanding of related techniques from a range of areas, including some outside engineering, and the ability to apply them effectively.

Intended Learning Outcomes

Knowledge and Understanding

- demonstrate a comprehensive knowledge and in depth understanding of mathematical and computer models relevant to the discipline
- develop a critical awareness of the limitation of such techniques

Skills and Attributes

- demonstrate self direction in the use of mathematical and computer modelling techniques.
- apply modelling techniques to complex problem solving.
- critically appraise the use of alternative modelling techniques and their limitations.
- communicate critical analysis and outcomes effectively

Generic Module

Mechanical Engineering, Manufacturing Systems Engineering and Aeronautical Engineering

This module will focus on the understanding and application of mathematical and computer modelling techniques in the context of the student's engineering discipline and employment. Within the module, training and experience will be drawn from a range of topics, depending on the student's role within the company and on the company's activities.

Typical examples might be:

- stress analysis of structures.
- fatigue life prediction.
- thermal modelling of electrical, electronic or electro-mechanical systems or components.
- performance predictions.
- reliability predictions.
- analysis of field or test data.
- manufacturing processes and control simulation
- operations management.
- supply chain.

Actual Module Content

This module will focus on the mathematical and computer modelling techniques currently being used on the *<suppressed>* project. Below is a list of the types of models in use with their related software packages bracketed:

Computational Fluid Dynamics (CFDesign)

Finite Element Analysis (ANSYS)

Moldflow

Tolerance Stack Analysis (Excel & CETOL)

Rigid Body Dynamics (Working Model)

Math Modelling (Excel and MathCAD)

Computer Aided Design (ProEngineer)

Apart from the use of Excel modelling techniques no previous experience has been gained in the use or application of any of the above packages. Selection of a project task that encompasses the use of one or more of these will greatly enhance understanding of the analytical tools currently in use in the DTG. It will also provide an insight into where they can be successfully

applied and also their strengths and limitations in other areas of the project. Where possible real data and theoretical data will be compared and the differences discussed.

Assessment Details

In order to obtain 15 credit points towards the MSc in Professional Engineering this Work Based Learning (WBL) module is subject to a 100% in-course assessment. It will draw upon past and/or current experience through an approved programme of application and study.

The submission will comprise of a referenced submission of at least 5,000 words (or equivalent) and an accompanying portfolio of evidence.

The format and content of the portfolio will be dependent upon the work based learning context and evidence may typically include, but is not limited to:

- work evidence that demonstrates subject knowledge and skills.
- extended literature review covering the chosen modelling technique(s).
- evaluation of alternative technologies and evaluation of their applications.
- experimental results.
- outcomes from professional training courses, if appropriate.

Mathematical and Computer-based Problem Solving

Module Code: MAAD0042

School of Aerospace, Automotive and Design Engineering

IET Learning Outcomes

The IET Handbook of Learning Outcomes [2] states Masters graduates may be characterised by the following attributes:

M6 – *"Ability to apply mathematical and computer-based models for solving problems in engineering, and the ability to assess the limitations of particular cases".*

M7 – *"Ability to extract data pertinent to an unfamiliar problem and apply them in its solution, using computer based engineering tools when appropriate".*

Module Aims

- develop an in depth understanding of mathematical and computer-based models for solving problems, and identify their limitations.
- demonstrate ability in the application of mathematical and computer-based problem solving techniques.

Intended Learning Outcomes

Knowledge and Understanding

- demonstrate a comprehensive knowledge and in depth understanding of mathematical and computer models applied within the discipline.
- develop a critical awareness of the limitations of such techniques.

Skills and Attributes

- apply mathematical and computer-based models and tools to solve problems, and assess their limitations in specialist contexts.
- analyse complex, contradictory and/or incomplete information as part of problem solving process.
- communicate outcomes and findings effectively.

Generic Module

Mechanical Engineering, Manufacturing Systems Engineering and Aeronautical Engineering

This module will focus on the understanding and application of mathematical and computer-based problem solving in the context of the student's engineering discipline and employment. Within the module, training and experience will be drawn from a range of topics, depending on the student's role within the company and on the company's activities.

Typical examples might be:

- application of standard techniques within a company or organisation.
- development or extension of available problem-solving techniques into new or related technical areas.
- development of new methods and/or software for solving generic or specific problems.
- application of FEA, CFD, simulation, statistical or other software modelling/problem solving packages.

Actual Module Content

It is likely there will be some overlap between this module and the previous one titled "Mathematical and Computer Modelling Techniques". In fact it is planned to use the conclusions of that module to select the most appropriate technique or techniques to model a problem which is currently being worked on.

One aspect of the *<suppressed>* is to design and optimise a *<suppressed>* which allows the *<suppressed>* to be attached to a *<suppressed>*. Although these methods of attachment are common in the *<suppressed>* industry, it is the first time that *<suppressed>* has utilised such on one of its products. The successful function of this snap-fit is key to the *<suppressed>* meeting its user requirements. Appropriate modelling techniques can be used to assist in selecting the optimum design for this *<suppressed>*. Then, having recently commissioned an automated test rig for this purpose, it will be possible to test samples under simulated production assembly conditions to compare actual and theoretical data. Accelerated stability testing can also be utilised to predict performance through life. The objective of the exercise will be to prove the following attributes are the most suitable for the application:

- *<suppressed>*
- *<suppressed>*
- *<suppressed>*
- *<suppressed>*

Assessment Details

In order to obtain 15 credit points towards the MSc in Professional Engineering this Work Based Learning (WBL) module is subject to a 100% in-course assessment. It will draw upon past and/or current experience through an approved programme of application and study.

The submission will comprise of a referenced submission of at least 5,000 words (or equivalent) and an accompanying portfolio of evidence.

The format and content of the portfolio will be dependent upon the work based learning context and evidence may typically include, but is not limited to:

- work evidence that demonstrates subject knowledge and skills.
- extended literature review covering snap fit design and material properties
- evaluation of alternative snap fit designs and evaluation of their applications.
- experimental results.
- outcomes from professional training courses, if applicable

Design Processes and Methodologies

Module Code: MAAD0043

School of Aerospace, Automotive and Design Engineering

IET Learning Outcomes

The IET Handbook of Learning Outcomes [2] states Masters graduates may be characterised by the following attributes:

M8 – *"Wide knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations".*

Module Aims

- develop a wide knowledge and comprehensive understanding of design processes and methodologies.
- be able to apply and adapt design processes and methodologies to unfamiliar situations.

Intended Learning Outcomes

Knowledge and Understanding

- demonstrate a systematic understanding of design processes and methodologies.
- demonstrate a comprehensive understanding of design processes and methodologies and their applications.
- understand the individual and team working dynamics of design and development.

Skills and Attributes

- show originality in applying and adapting design processes and methodologies to unfamiliar situations.
- work effectively individually and/or within a team.

Generic Module

Mechanical Engineering, Manufacturing Systems Engineering and Aeronautical Engineering

This module will focus on the understanding and application of scientific principles and technologies in the context of the student's engineering discipline and employment. Within the module, training and experience will be drawn from a range of topics, depending on the student's role within the company and on the company's activities.

Typical examples might be:

- application of the design process to a company-specific product or system.
- use of design tools and methodologies in the development of products or systems.
- setting up or development of a knowledge-management/capture system for use in the design process.
- development of analytical methods in support of the design process.
- analysis of various design methodologies to determine the most appropriate for a specific task or application.
- implications of manufacturing technologies and supply systems.
- design and implementation processes and management processes.
- market, technology and commercial risk evaluation and management.

Actual Module Content

This module will look at how *<suppressed>* devices are provided to support *<suppressed>* products from initial proof of concept, through *<suppressed>*, during *<suppressed>* and finally through to *<suppressed>* scale up. It will detail how risk is managed throughout the project and the commercial factors affecting decision making.

<suppressed> are of no use unless they have a *<suppressed>* product to deliver. Although, they are key to the administering of some *<suppressed>* and can provide a platform to be used with multiple products they would not exist unless there was *<suppressed>* for them to deliver. For this reason the fate of some *<suppressed>* can be decided by the success or failure of the product it has been commissioned to support.

When launching new *<suppressed>*, as with any other product, the R&D programme passes through a number of phases. At the end of each of these phases there is a decision gate where, based on a body of available evidence, it is decreed whether or not the product will pass to the next development phase and then eventually to commercial launch. In

<suppressed> terms *<suppressed>* is the point in the project where the product is being scaled up for launch. At the same time a file containing all the information pertinent to the product is being prepared for submission to the relevant *<suppressed>* for approval.

As the product passes through the various phases the engineering and technological support required increases. For example, during the early stages, simple hand assembly equipment is all that is required to put devices together but as demand grows so does the need for semi or fully automated equipment. This automated equipment will give higher production rates but will be far less forgiving to components that have been poorly designed for assembly. This is also true for injection mould tools, as the cavitations in the tools increase so potentially does the variability in the components they are producing, leading to possible assembly issues. One argument would be to introduce this complexity as early as possible in the project but this needs to be balanced against the commercial and financial risks.

Assessment Details

In order to obtain 15 credit points towards the MSc in Professional Engineering this Work Based Learning (WBL) module is subject to a 100% in-course assessment. It will draw upon past and/or current experience through an approved programme of application and study.

The submission will comprise of a referenced submission of at least 5,000 words (or equivalent) and an accompanying portfolio of evidence.

The format and content of the portfolio will be dependent upon the work based learning context and evidence may typically include, but is not limited to:

- work evidence that demonstrates subject knowledge and skills.
- extended literature review covering medical device design and manufacture.
- evaluation of alternative technologies and evaluation of their applications.
- technology specifications.

New Technology & Design Innovation

Module Code: MAAD0044

School of Aerospace, Automotive and Design Engineering

IET Learning Outcomes

The IET Handbook of Learning Outcomes [2] states Masters graduates may be characterised by the following attributes:

M5 – *"An ability to fundamental knowledge to investigate new and emerging technologies".*

M9 – *"Ability to generate an innovative design for products systems, components or processes to fulfil new needs".*

Module Aims

- apply fundamental knowledge to research and investigate new and emerging technologies and their applications.
- evaluate alternative design concepts for products, systems, components or processes to fulfil new needs.
- develop an ability to generate innovative designs for products, systems, components or processes.

Intended Learning Outcomes

Knowledge and Understanding

- identify potential new technologies and critically research their application.
- demonstrate an in depth understanding of the principles and practice applicable to innovation in design.

Skills and Attributes

- demonstrate a systematic ability to apply knowledge and understanding to the evaluation of new and emerging technologies and their potential applications.
- critically evaluate potential applications.
- generate innovative designs for products, systems, components or processes to fulfil new needs.
- communicate complex technical information and new proposals effectively.

Generic Module

Mechanical Engineering, Manufacturing Systems Engineering and Aeronautical Engineering

This module will focus on the understanding and application of new and emerging technologies and design innovation in the context of the student's engineering discipline and employment. Within the module, training and experience will be drawn from a range of topics, depending on the student's role within the company and on the company's activities.

Typical examples might be:

- evaluation of new techniques and methods in terms of their application to an existing product or service.
- evaluation of new materials and their application to existing projects as replacements for existing materials.
- identification of new opportunities made available by new materials and techniques.
- cost-benefit analysis of adopting new technologies.
- prediction of future availability of technologies.
- development of new methods, materials or techniques.
- development or evaluation of new design methods to suit a particular requirement.
- incorporation of existing materials or techniques in new or different ways.

Actual Module Content

In order to ensure the seamless transition of a *<suppressed>* from initial conception and design to commercial scale production, one of the key factors is the ability of the many components to be automatically assembled at high speed. This module details the Design for Assembly (DFA) assessment carried out on the components of the *<suppressed>*.

While the *<suppressed>* is still in the early design phase it is the optimum time to incorporate component changes that will assist with automated assembly. Not only can these changes be assessed for their benefits to the assembly process but they can also be tested to ensure that they have no effect on the *<suppressed>* function.

Each component will be assessed for automated assembly and the following points will be considered:

- Feeding from a bowl in a known orientation
- Feeding using a linear feed system in a known orientation
- Features to aid separation at the end of a linear feed system
- Features to enable pick and placing without damage
- Features to maintain orientation during pick and place operations

The module report will include component details and any resultant changes post the DFA assessment.

Assessment Details

In order to obtain 15 credit points towards the MSc in Professional Engineering this Work Based Learning (WBL) module is subject to a 100% in-course assessment. It will draw upon past and/or current experience through an approved programme of application and study.

The submission will comprise of a referenced submission of at least 5,000 words (or equivalent) and an accompanying portfolio of evidence.

The format and content of the portfolio will be dependent upon the work based learning context and evidence may typically include, but is not limited to:

- work evidence that demonstrates subject knowledge and skills.
- extended literature review on the subject of Design for Assembly
- evaluation of alternative technologies and evaluation of their applications.
- technology specifications.

Management, Business Practices and Risk Management

Module Code: MAAD0046

School of Aerospace, Automotive and Design Engineering

IET Learning Outcomes

The IET Handbook of Learning Outcomes [2] states Masters graduates may be characterised by the following attributes:

M10 – *"Extensive knowledge and understanding of management and business practices, their limitations and how these may be applied appropriately".*

M11 – *"The ability to make general evaluations of commercial risks through some understanding of the basis of such risks".*

Module Aims

- develop an comprehensive understanding of management and business practices, and their limitations, and how these may be applied appropriately.
- make critical evaluations of commercial risks through an understanding of the basis of such risks.

Intended Learning Outcomes

Knowledge and Understanding

- develop a critical knowledge of relevant management and business practices and their limitations.
- examine commercial risk evaluation concepts and their applications

Skills and Attributes

- be able to make critical evaluations of commercial risks by the use of appropriate techniques.
- use analysis techniques appropriately in synthesising information.
- communicate complex information and outcomes of decision making processes effectively.

Generic Module

Mechanical Engineering, Manufacturing Systems Engineering and Aeronautical Engineering

This module will consider issues including:

- the commercial and economic context of engineering practice: the market, technology exploitation, business planning and finance.
- management techniques including project and risk management, decision making and operations management.
- sustainable development in: design and manufacture, waste management and recycling, legislation.
- relevant legal requirements: data protection, freedom of information, health and safety, contract law, copyright and patent law, professional and product liability.
- professional, ethical conduct and codes of practice and conduct.

Actual Module Content

The *<suppressed>* ndustry is a *<suppressed>* one and any company wishing to launch a new product will require the approval of the *<suppressed>*. *<suppressed>*, the word's largest consumer of *<suppressed>*, is regulated by the *<suppressed>*, while in the UK the role is carried out by the *<suppressed>*. Traditionally, *<suppressed>* companies have built in multiple levels of quality control (QC) testing to prove the ongoing safety and efficacy of their products to these regulatory authorities, with the obvious resulting delays in the supply chain. This also meant that the supplying companies would be reluctant to change anything in the production process, even if for cost saving or efficiency purposes, for fear of having to *<suppressed>.*

In recent years these same authorities have encouraged a Quality by Design (QbD) approach [3]. *<suppressed>* interpretation of this has been to tailor a Design for Manufacture (DFM) approach encompassing QbD. By taking time to learn as much as possible about the product during the research and development and scale up phases it will be possible to minimise the amount of QC testing in full scale production by using techniques such as parametric release. It will also demonstrate to the regulatory bodies a deep level of understanding of the product within the company.

How this approach translates into day to day operations in the *<suppressed>* is via a management expectance for DFM to be built in to every stage of a project. It consists of four main areas as follows:

1. Design Intent
2. Design Selection
3. Control Definition
4. Control Verification

This module will explain how the *<suppressed>* adheres to this DFM approach and detail some of the design methodologies involved.

Assessment Details

In order to obtain 15 credit points towards the MSc in Professional Engineering this Work Based Learning (WBL) module is subject to a 100% in-course assessment. It will draw upon past and/or current experience through an approved programme of application and study.

The submission will comprise of a referenced submission of at least 5,000 words (or equivalent) and an accompanying portfolio of evidence.

The format and content of the portfolio will be dependent upon the work based learning context and evidence may typically include, but is not limited to:

- work evidence that demonstrates subject knowledge and skills.
- extended literature review on the subjects of Design for Manufacture and Quality by Design
- evaluation of alternative technologies and evaluation of their applications.
- technology specifications.

Technology, Practice, Developments and Applications

Module Code: MAAD0047

School of Aerospace, Automotive and Design Engineering

IET Learning Outcomes

The IET Handbook of Learning Outcomes [2] states Masters graduates may be characterised by the following attributes:

M12 – *“A thorough understanding of current practice and its limitations and some appreciation of likely new developments”.*

M13 – *“Extensive knowledge and understanding of a wide range of engineering materials and components”.*

M14 – *“Ability to apply engineering techniques taking account of a range of commercial and industrial constraints”*

Module Aims

- gain an awareness of a wide range of commercial processes and practice and their limitations.
- develop an ability to apply technologies and/or methodologies taking account of a range of commercial and industrial constraints.

Intended Learning Outcomes

Knowledge and Understanding

- develop an in depth understanding of current practice and their limitations.
- understand the commercial and industrial constraints associated with technology implementation in their discipline.

Skills and Attributes

- critically evaluate technologies, processes and practice taking into account their limitations.
- demonstrate a critical appreciation of new developments.
- communicate awareness, applications and a balanced analysis effectively.

Generic Module

Mechanical Engineering, Manufacturing Systems Engineering and Aeronautical Engineering

Consideration should be given to reporting requirements including:

- an understanding of customer needs.
- product and/or process specifications.
- working practices, standards, procedures and documentation requirements
- communication and reporting requirements and procedures

Actual Module Content

This module will detail the production requirements of the complete *<suppressed>* taking into account supply chain as well as equipment issues.

In order for the *<suppressed>* to be manufactured on a commercial scale the necessary equipment and facilities need to be in place. Currently, a similar nasal device is produced at one of *<suppressed>*. The similarities between the two products mean that there may be some overlap between the equipment that is used to produce them.

The basic process is as follows:

- Filling of a measured amount of *<suppressed>*.
- Fitting of a pre-assembled *<suppressed>*.
- Fitting of the *<suppressed>* sub assembly into an *<suppressed>*
-

By carrying out a comparison of the two processes it will be possible to pinpoint which aspects require further development in order to accommodate the *<suppressed>*. It will also be an opportunity to discuss with the production personnel at *<suppressed>* any supply chain bottlenecks and equipment issues they are currently experiencing. By involving a multi skilled team it will be a forum for sharing best practice as well as areas that are in need of improvement. Opportunities for utilising new technology and methodologies can also be discussed.

In order to implement a commercial scale supply chain for the *<suppressed>* considerable investment will be required on the part of *<suppressed>* not only at its own production premises but also at that of its secondary suppliers. This module will also detail how this investment is budgeted and controlled over the various phases of the project.

Assessment Details

In order to obtain 15 credit points towards the MSc in Professional Engineering this Work Based Learning (WBL) module is subject to a 100% in-course assessment. It will draw upon past and/or current experience through an approved programme of application and study.

The submission will comprise of a referenced submission of at least 5,000 words (or equivalent) and an accompanying portfolio of evidence.

The format and content of the portfolio will be dependent upon the work based learning context and evidence may typically include, but is not limited to:

- work evidence that demonstrates subject knowledge and skills.
- extended literature review covering *<suppressed>* Manufacture and *<suppressed>* filling and assembly.
- evaluation of alternative technologies and evaluation of their applications.
- technology specifications.

Individual Project

Module Code: MAAD0045

School of Aerospace, Automotive and Design Engineering

Module Aims

- develop an ability for original and creative work and to undertake an independent study/research.
- develop a creative and innovative skill-set in the application of technology within their industry.
- develop effective communication skills and learn effectively and independently in preparation for lifelong learning.

Intended Learning Outcomes

Knowledge and Understanding

- develop a critical knowledge and systematic understanding of a range of research methods employed in the analysis of commercial and technical problems.
- develop a sound knowledge of the chosen fi

Skills and Attributes

- identify, plan and manage an in-depth study in the relevant field
- demonstrate extensive research skills related to industrial/technology problem solving.
- communicate the scope of the research, its context and outcomes effectively.

Generic Module

Mechanical Engineering, Manufacturing Systems Engineering and Aeronautical Engineering

The individual project forms the culmination of the MSc in Professional Engineering and allows the student to apply their skills and knowledge to a specific problem or technological development. It comprises a supervised investigation of, for example, a technology/commercial problem, case study, technological development, which may take a design, experimental, research or analytical character or combination of these facets. Projects will usually be set in the context of the student's current employment setting.

The student will define an appropriate set of project aims/objectives and implementation plan which must be approved by the supporting company and a designated academic supervisor. Through a process of analysis and evaluation the student will progress through an interim progress report and ultimately present his/her findings through the submission of a final written report and oral presentation. The project represents approximately 600 hours of work/study and must make a worthwhile practical and/or academic contribution to the subject area in question.

Actual Module Content

For any *<suppressed>* project one of the major milestones is when production scale injection moulding and assembly equipment is fully installed and ready for use. This will be the culmination of much effort in many areas of the business. As this equipment will be based at a secondary supplier to *<suppressed>* it also requires the building of a relationship built on trust and openness. Another factor is increasing pressure from regulatory bodies to adopt the latest technological advances into process equipment so there will also be a desire to comply with these expectations [4].

The objective of this project will be to cover in detail the various engineering, and commercial aspects required to bring this equipment readiness to fruition. Areas covered will be as follows:

- Engineering
    - Device Design for Manufacture and Assembly
    - Equipment Specification and Validation
    - Process Analytical Technology (PAT)
    - Project Planning and Resourcing
    - Health and Safety Regulation
- Commercial
    - Budgeting
    - Supply Logistics
    - Supplier Selection

The intention is to draw on the learning outcomes from the previous modules carried out as part of the MSc Professional Engineering and to show progression by their application during this project.

Assessment Details

In order to obtain the final 60 credit points required to complete the MSc in Professional Engineering this Work Based Learning (WBL) Individual Project will be assessed in two stages.

The intended learning outcomes of the project will be assessed initially upon submission of: an interim report showing progress in-line with the agreed project aims/objectives and plan, and a final report and presentation. The assessment will typically include:

- an interim report 30%.
- an extended literature review covering the project subject matter.
- final report 70%'
- a presentation on the subject matter.

References

1. UK Standard for Professional Engineering Competence (2005), “Chartered Engineer and Incorporated Engineer Standard”, p12, Engineering Council UK.
2. IET Handbook of Learning Outcomes for BEng and MEng Degree Programmes (2006), p11 Institution of Engineering and Technology
3. Guidance for Industry - Quality Systems Approach for <suppressed>
4. <suppressed>.