



PEARSON BTEC

HNC LEVEL 4 CERTIFICATE / HND LEVEL 5 DIPLOMA

IN

MANUFACTURING ENGINEERING

COURSE HANDBOOK 2018 - 19

Contents

Section		Page
1	Welcome	3
2	Course Team	4
3	The Course and Programme Specification	5
4	Additional Course Specific Information	9
5	Assessment	10
	5.1 Assessment Schedule	10
	5.2 Assessment Regulations	10
	5.3 Extenuating Circumstances	11
	5.4 Malpractice	13
	5.5 Appeals	14
	5.6 Complaints	15
	5.7 Marking Arrangements	17
	5.8 Guidance on Referencing	17
	5.9 Notification of Results	18
	5.10 Provision of Certificates and Diploma Supplements	18
	5.11 Graduation	18
6	Learning Resources	19
7	Opportunities to Engage in Quality Assurance of the Course	22
8	Opportunities for Further Study	23
9	Units of Study	24

1. Introduction

1.1 Welcome to the Sheffield College

Congratulations on choosing higher education at the Sheffield College. We hope that the time you spend with us will be both enjoyable and rewarding and that you will be able to take full advantage of all that the College and the City of Sheffield have to offer.

Starting a new course can be a confusing and worrying time. As a group of students you come with a wide range of experiences. Some of you are living away from home for the first time; others have lived or worked in Sheffield for a considerable period. Some of you have come from school or college, others are returning to study after several years working outside the education system. You come in all shapes and sizes, age ranges, ethnicity and gender, from the UK, The European Union and other countries. What you all have in common is that you are about to begin study for the first time at higher level. We hope that you will quickly make friends within the group and that the group as a whole binds together so that you all support each other. In many ways you are each other's most important resource.

We hope you will find that the course you have chosen fulfils all your expectations and that by the time you leave us you will be fully equipped to meet the demands of employment and your chosen career path.

Steve Tipping Head of HE and Access

1.2 The College

The Sheffield College has around 20,000 students in total, 600 of which are on university level courses. Higher Education at the Sheffield College operates across 2 campuses; City and Hillsborough. Higher Education is based within departments in order to give you access to specialist facilities. Each course has a designated HE Curriculum Leader, who is responsible for the day to day running of your course, and is your first point of contact.

We are proud of our vocational facilities, which are among the best in the north of England, and our staff work hard to ensure you get a valuable experience when using them. You will find your tutors and support staff approachable and available to help you every step of your journey. For us, your time here is 'all about you' and we hope that you will work with us to continue to build a vibrant HE community.

1.2 Purpose of this handbook and how to use it

An important aspect of offering high quality courses of study in higher education is the provision of information for students which is accurate, comprehensive and reliable for your learning needs.

In support of this objective, this handbook is designed to meet the expectations of the QAA Code of Practice for the Assurance of Academic Quality and Standards in Higher Education.

The handbook provides information about your course team, the course you have chosen to study, assessment, personal academic and pastoral support, learning resources, quality assurance, work-based learning and opportunities for further study. It is a document that you will need to dip into during the course, when you need to look up, for example, what to do if you are ill. It contains the rules by which we all must live; so keep it in a safe place for future reference.

2. Course Team

2.1 Contacting Staff

At the Sheffield College we are proud of the amount of tutor support we provide. We encourage you to contact tutors if you need any help or support with your work, or if you have any queries about their unit. Whilst you can often catch staff in their workrooms during breaks, email is usually the best method of contact at other times, as tutors have busy teaching commitments and may not be readily available by phone. If you do contact by phone, be prepared to leave a message with your phone number; your tutor will always phone you back to arrange a time to meet with you to discuss any concerns you may have.

As well as having tutors for different units of the course, each course has an HE Curriculum Leader, who is responsible for the day to day running of the course. You should contact the HE Curriculum Leader if you have any queries concerning the course and how it operates, or if you are unable to attend class for any reason, for example due to illness.

In addition, groups of courses are managed by a Director. You are unlikely to need to make contact with the Director, unless your HE Curriculum Leader is absent from College for any length of time. Contact details for individual tutors will be given to you in class, by the tutors themselves. Contact details for your HE Curriculum Leader and Director are listed below.

Course	Curriculum Leader	Director
Manufacturing Engineering	Ronan Keaney	Steve Elliot
HNC/D	ronan.keaney@sheffcol.ac.uk	Steve.elliot@sheffcol.ac.uk
	Tel: 0114 260 3688	Tel: 0114 260 3691

2.2 The Sheffield College University Centre

The College has a dedicated specialist University Centre to service HE students. This is your first point of contact for all administrative queries. The administrator, Sue Fletcher can be contacted on 0114 260 2597 <u>susan.fletcher@sheffcol.ac.uk</u> Sue will either be able to answer your query herself, or give you the contact details of the appropriate person to help you. Carol Sheldon, <u>carol.sheldon@sheffcol.ac.uk</u> and Julia Mills, <u>julia.mills@sheffcol.ac.uk</u> are part time HE Administrators. The Head of HE and Access, Steve Tipping can be contacted on 0114 260 2587 <u>stephen.tipping@sheffcol.ac.uk</u>

3. The Course

3.1 Programme Specification

This is the Programme Specification for your proposed course. It gives you information about how you will be taught, assessed, and supported whilst at college.

What Award Will I Get?

Pearson BTEC Level 4 HNC Diploma in Manufacturing Engineering Pearson BTEC Level 5 HNd Diploma in Manufacturing Engineering

Is It Approved By Any Professional Body?

Pearson BTEC Higher Nationals are designed to provide a specialist vocational programme, linked to professional body requirements and National Occupational Standards where appropriate.

The qualifications provide a thorough grounding in the key concepts and practical skills required in their sector and their national recognition by employers allows direct progression to employment.

Aims of the Programme

This qualification is designed to equip individuals with the knowledge, skills and experience to be able to gain employment in the mechanical manufacturing or engineering industries or to progress onto undergraduate degrees.

Learning Outcomes of the Programme

They place a strong emphasis on developing specialist knowledge and understanding, and are recognised internationally by employers as providing learners with the key concepts required for progression to, or within, employment.

How will I be taught?

The course is delivered over two years and students will study a range of core and optional units in both years. The first year will focus on the key principles of manufacturing engineering and working on professional projects. Students will also have the option to study CAD.

	Learning Methods	
Knowledge and Understanding	lectures and seminars	
	 directed study of textbooks and journal 	
	articles	
	 assignment work 	
	 project work 	
Intellectual Skills	 more active learning processes 	
	 assignments or projects 	
	 group-learning activity such as a seminar or 	
	tutorial	
Subject Specialist Skills	 application in context 	
	 workbooks or guidance manuals may also be 	
	used to support learning	
Key Skills	 through naturally arising opportunities within 	
	the curriculum e.g. written communication	
	skills through essays or dissertations	
	 oral communication skills through 	
	presentations in seminars	
	 team working skills through collaborative 	
	projects	

What will my timetable look like?

Below shows the basic structure of your Programme.

Level 4 / HNC

Core/Mandatory Units

- Engineering Design
- Engineering Maths
- Engineering Science
- Managing a Professional Engineering Project
- Production Engineering for Manufacture
- Quality and Process Improvement

Optional Units

- CAD/CAM
- CAD for Maintenance Engineers

Level 5 / HND

Core/Mandatory Units

- Research Project
- Professional Engineering Management
- Manufacturing Systems Engineering
- Lean Manufacturing
- Advanced Manufacturing Technology

Optional Units

- Further Mathematics
- Sustainability

How will I be Assessed?

	Assessment Method	
Knowledge and Understanding	Most methods require some demonstration of	
	knowledge and understanding	
Intellectual Skills	 Problem-based exercises 	
	 Independent project work 	
	Research dissertations	
Subject Specialist Skills	Application in context	
	 Practical demonstration of skill 	
Key Skills	 Through naturally arising opportunities within the curriculum 	
	 E.g. written communication skills through essays or dissertations 	
	 Oral communication skills through presentations in seminars 	
	 Team working skills through collaborative projects 	

What Are My Responsibilities As A Student?

It is your responsibility to manage your personal and professional development. You will be mentored and supported in this by the personal tutor. The amount of support given will be driven by your needs, as determined by you and / or Unit tutors, and is therefore expected to decrease in quantity and nature as you progress through the course and become more independent.

HNC/Ds are vocational courses which prepare you for working in a professional environment as well as to undertake further study. These courses require you to behave in a professional manner, in much the same way as you would in a working environment. Therefore we expect your attendance rate to be high, and that if you have to miss a class for some unavoidable reason, you inform your Curriculum Leader, and make arrangements to catch up the class you miss. Our courses move at a fast pace, and there is a strong relationship between good attendance and success.

Group work is a key component of all courses, and will form part of your assessment. Good attendance enables you to build working relationships with your peers and play your full part in collaborative activities. Being able to work as part of a team is an important employability skill, and is highly valued on our courses.

For all these reasons, your personal tutor will monitor your attendance and, should an issue arise for any reason, will help you to action plan so that you get back on track. However, it is your personal responsibility to ensure that you attend, and in particular that you **do not** take holidays during term time. To help you with your planning, you will receive a college calendar at induction.

The College reserves the right to withdraw you from your course should your attendance pattern indicate a lack of commitment to your studies with the likelihood that you will not successfully complete the course. If you do not attend for 4 consecutive weeks, or have a pattern of haphazard attendance, you will be withdrawn and the student loans company will be informed. This will result in your funding being stopped, and you will owe the college the balance of any unpaid fees.

It is your responsibility to keep a copy of all written coursework submitted.

What Support And Help Can I Get?

Your personal tutor is there to support and guide you on your learning journey and is your first point of contact if you have any concerns or need to access support, counselling or careers guidance. Your personal tutor will be responsible for writing your reference when you apply for further courses or employment. You will be given contact details for your personal tutor during induction.

You will receive academic support from your Unit tutors. This may take the form of face to face academic tutorials, advice surgeries and appointments or remotely by telephone or email conversations and conferences on the college intranet. Never be afraid to ask for help or advice - we are here to support you. Unit tutors will provide you with contact details during the first lesson.

Other Sources of Support

During induction you will be given details of all the support services which the college provides. Each Campus has a Student Services base staffed by a manager and a team of staff who are there to support you throughout your time at College. This team of staff includes our own Educational Guidance Advisors who can advise you about appropriate courses, careers etc. As a student of the college you have access to free and confidential counselling where you may find it helpful to talk to someone who won't judge you.

The College offers a wide range of assistance to learners with additional needs. We believe that everyone should be enabled to learn effectively and have access to College facilities.

Learners with additional needs include people with:

- physical or mobility difficulties
- visual impairment e.g. blind and partially sighted
- hearing Impairment e.g. deaf or hard of hearing

- communication difficulties e.g. Autistic and Asperger syndrome
- learning difficulty e.g. dyslexia, ADHD
- medical condition e.g. epilepsy, diabetes and heart disease
- mental health difficulties e.g. depression and anxiety

In order to access specialist support you must apply for Disabled Students Allowance. You need to complete an online <u>application form</u> and send the documents requested to Student Finance England, who will assess your claim. If successful, they will fund you to attend an assessment centre where your particular support needs can be assessed. For more information visit <u>Disabled Students' Allowances</u>. If you need help with the process, contact Liz Escadale, the HE Disabled Student Advisor, on 0114 2602075.

How Can I Find Out More?

The College has a dedicated specialist University Centre to service HE students. This is your first point of contact for all administrative queries. The administrator, Sue Fletcher can be contacted on 0114 260 2597 <u>susan.fletcher@sheffcol.ac.uk</u> Sue will either be able to answer your query herself, or give you the contact details of the appropriate person to help you. Working with the administrator is the Head of HE and Access, Steve Tipping, who can be contacted on 0114 260 2587 <u>stephen.tipping@sheffcol.ac.uk</u>.

4. Course Specific Information

Course

HNC/D Manufacturing Engineering

Additional Costs

None

Equipment

None

Printing /Reprographic Costs

None

Residential Trips

None

Please include any other course specific information not given elsewhere

None

5. Assessment

5.1 Assessment Schedule

Deadlines will be given for each unit during the first lesson for that module, and published in unit guides and the course assessment schedule.

5.2 Assessment Regulations

All HE students are entitled to have access to fair assessment. The College follows QAA and Awarding Body guidance regarding reasonable adjustments and special considerations. Teachers, trainers and assessors will follow the procedures, and design assessment instruments that give all candidates the fairest possible opportunities to show attainment. Internal verifiers will check that assessments give all students equal opportunities to show attainment, and that there is no discrimination or bias in the design or format.

All courses have a Review Board at the end of each semester. These boards confirm your results for all completed modules, and for the award at the end of the course. <u>Pearson BTEC HNC/D regulations</u> require us to specify a set of rules that all HNC/D programmes adhere to, and which are considered during the Review Board. These rules are listed below:

- all students must meet the pass or merit or distinction criteria to achieve each unit
- if there are exceptional circumstances explaining why a student is unable to meet deadline dates, the decision to defer outstanding work must be agreed by an Exceptional Circumstances Panel. It follows that the Exceptional Circumstances Panel must meet prior to the Review Board.
- If a student does not achieve the pass standard for the first submission of summative assessment of the unit, s/he will be given a refer grade, and will be required to resubmit work by a clearly stated deadline. The grade awarded will depend upon the student profile for the unit.
- the outcome of the refer work will be discussed at the next Review Board; if still not at the required standard, the student will fail the unit and will need to re-register, subject to the unit's availability
- if it is not possible for a student to retake all re-registered units during the planned 2 years, then a decision to allow a student to continue for a 3rd year of the course may be taken at the discretion of the Assessment Board
- all students are to be provided with feedback on their work within 3 weeks of the deadline date
- units that are assessed using group work must also include measurable assessment of the contribution of each individual student

Standards Verifiers consider samples of student work to verify quality and standards. The Review Board will consider their comments about these samples whether or not it is possible for the Standards Verifier to attend in person. Each Review Board must also report progress on actions taken in response to any Standards Verifier recommendations.

No discussion of individual results or counselling of students takes place prior to the Review Board. Discussions that take place during the Review Board are strictly confidential. Only the board decisions are reported to you.

Your Standards Verifier is Mr G Mason. Email <u>g.mason@peterborough.ac.uk</u> and contact number is 01354 688056.

5.3 Extenuating Circumstances

The Sheffield College's Extenuating Circumstances Policy and Procedure is intended to provide support if you experience unexpected and unanticipated difficulties during your time as a student which adversely impacts on your studies and your ability to complete assessments or complete them to your usual standard.

If you are experiencing such difficulties, please refer to the Extenuating Circumstances Policy and Procedure for guidance and speak to a member of the teaching staff about your specific situation. They will be able to advise which procedure you need to follow and who to submit the relevant paperwork to.

The Extenuating Circumstances Policy and Procedure is available here, <u>https://www.sheffcol.ac.uk/about-us/terms-and-conditions</u> and click on *Extenuating Circumstances Policy & Procedure*. You will also find a link on your Moodle/Google classroom VLE site.

You should read this information if you are experiencing personal problems, for example, if you are ill, have been in hospital, have experienced an exceptional family emergency or are suffering from exceptional stressful life events, and they are having a significant impact on your ability to study.

Whilst studying with us you may well encounter some of the difficulties of life experienced by most people, such as ill-health or personal issues. Normally you will be able to overcome or manage these without any impact on your ability to study and complete assessment.

Occasionally however you might experience ill-health or personal issues that are exceptional in nature and which have a significant impact on your ability to study and to complete assessment. We define these as extenuating circumstances. Generally such circumstances will occur suddenly, will be unexpected and are beyond your immediate control to overcome or manage due to their severity and/or timing.

Our policy is to help you where we can to mitigate the impact of your extenuating circumstances on your studies and to consider all requests for help sensitively, fairly and equitably.

It is important you inform us as soon as you are aware that your studies and/or ability to take assessment are being affected by ill-health or personal issues. You should contact your **HE Curriculum leader** immediately if your circumstances are preventing you from attending classes or are affecting your ability to complete assessment. We understand you might not always feel comfortable doing this particularly when your circumstances are of a personal and sensitive nature. However we encourage you to do so. Any information you disclose will be handled in confidence.

The appropriate mechanism to help mitigate the impact of your circumstances will depend on the timing and severity of those circumstances.

- Where the circumstances occur close to a coursework submission deadline and are of the type that can quickly be overcome, you can request a short extension to that deadline.
- Where your circumstances will prevent any sustained meaningful engagement with your studies, then you can request a planned break in studies.
- Where your circumstances are having a detrimental impact on your ability to attempt or reach a pass standard in an assessment task, you can request to repeat your attempt at that assessment task.

We will consider any request sensitively, fairly and equitably based on the extent to which you have:

- Submitted the request in a timely manner.
- Clearly stated the nature of your circumstances and the impact they are having on your ability to study and take assessment.
- Provided appropriate documentary evidence where it can be reasonably obtained.

The Sheffield College will support students in completing a Request Repeat Assessment Task (RRAA) form.

The Sheffield College will hold Extenuation Circumstances Panels (ECPs) to determine if students RRAA will be accepted or declined following the Extenuating Circumstances Policy and Procedure process. The Sheffield College will confirm RRAA outcomes to students.

NB: The following list indicates the type of situations which do not meet the definition of extenuating circumstances because we believe they can be avoided or that you can act to limit the impact. The list is not exhaustive.

Medical

- long-standing medical conditions (as these should be covered by a Learning Contract)
- planned health appointments
- minor ailments such as a cold

Personal

- the break-up of a short-term relationship
- financial difficulties
- attending or taking part in sporting events
- holidays or travel
- moving house
- normal domestic issues
- work commitments for fulltime students reducing time available for study and coursework
- voluntary work
- weddings

Study related

- completing coursework too late and missing deadlines
- losing coursework
- not following the assessment timetable
- transport difficulties which could have reasonably been avoided
- withdrawal of IT facilities as a result of being in debt to the College
- circumstances that affect another individual in relation to group work
- English being a second language

For further information, please refer to The Sheffield College *Extenuating Circumstances Policy and Procedure*, a copy of which can be obtained from your HE Curriculum Leader.

5.4 Malpractice

Malpractice is any form of cheating, including plagiarism, collusion, impersonation and the use of inadmissible material. It is a breach of the College's Assessment Regulations. If malpractice is suspected, it will be established beyond all reasonable doubt before any formal sanction is imposed. The College views all instances of malpractice, including plagiarism, as a serious offence, and will respond to all allegations of malpractice in accordance with <u>Pearson BTEC HNC/D regulations</u>. This may require the College to report any suspected malpractice to the Awarding Body. It may also require the College to investigate, in which case the Student Disciplinary procedure will be used. Instances of malpractice that are upheld following investigation, will lead to disciplinary action.

For full details of the policy and procedures regarding Academic Misconduct, see <u>https://www.sheffcol.ac.uk/about-us/terms-and-conditions</u> and click on *Assessment Malpractice Policy & Procedure*. You will also find a link on your Moodle/Google classroom VLE site.

Malpractice includes:

Misconduct, for example:

- any form of impersonation
- falsification, fabrication or alteration of results, certificates or assessment evidence
- failure to follow Awarding Body regulations <u>Pearson BTEC HNC/D regulations</u> or the instructions or advice of assessors, supervisors or invigilators
- misuse of assessment or examination material
- taking unauthorised material into assessment rooms
- obtaining, receiving, exchanging or passing on assessment-related information during assessment sessions
- behaviour that disrupts or undermines the integrity of assessment
- any form of cheating to gain an unfair advantage
- deliberate destruction of another person's work
- resubmitting previously graded work

Collusion

- unauthorised co-operation between a learner and another person, in or outside of College, in the preparation and production of work that is eventually submitted by one or both learners as the outcome of his or her individual efforts
- allowing another student to copy your work You should not be discouraged from teamwork, as this is an essential key skill for many subject areas. However, methods of avoiding collusion, for example, the use of minutes, allocating tasks, agreeing outcomes, etc, are an essential part of team work, and the requirement to use such methods must be made clear to all students.

Plagiarism

Plagiarism is where a student submits someone else's work as if it is their own.

- copying work (artwork, images, artefacts, products, designs, words) from a published source and presenting the copied work as if it were the student's own
- the use of another person's work (artwork, images, artefacts, products, designs, words), with or without permission, without appropriately acknowledging the source

Examples of plagiarism include:

- copying from published text without an acknowledgement of source
- copying images, graphs, tables, art, music etc, without acknowledging the source

- copying small or large sections of assignments from other learners;
- downloading original material from the internet without acknowledging the source
- imitating too closely an existing work of art or music, design idea or concept

5.5 Appeals

Appeals may be made against the decisions e.g. on assessment, the decisions of a Review Board, Extenuating Circumstances Panel or Academic Conduct Panel, on the grounds stipulated in these regulations, no later than 10 days from receiving the decision against which you wish to appeal.

For full details of the appeals regulations, see <u>https://www.sheffcol.ac.uk/about-us/terms-and-conditions</u> and click on *Academic Appeals Policy & Procedure*. You will also find a link on your Moodle/Google classroom VLE site. You are advised to read these regulations in full.

Grounds for appeal can relate to decisions made about procedures such as:

- exceptional extensions
- extenuating circumstances
- academic misconduct

Grounds for appeal can include:

- that there was an error or irregularity in the process
- that the decision was not in accordance with the relevant regulations
- that the person or panel making the decision did not take sufficient account of the circumstances

Failure to follow College procedures and deadlines does not in itself constitute grounds for an appeal. The appeal process should not be used as an opportunity to simply re-enter the procedure under consideration, and documents etc., originally submitted after the relevant deadlines, that were not considered when the original decision was taken, will not necessarily be taken into account during the appeal.

You cannot appeal against an academic judgement of the marks awarded but you may request confirmation of their validity if you think there has been an error or irregularity. You are therefore strongly advised to discuss the nature of the appeal with appropriate members of staff.

Assessment Appeal

If you are not happy with your provisional grades, you must discuss your concerns with the subject tutor in the first instance. He or she will then discuss the reason for the decision for awarding the provisional grade. If you are still not happy with the outcome of discussions over provisional grades with your tutor, then discuss your concerns with the Curriculum Leader. He or she will discuss the decision with the subject tutor and/or an internal verifier. If you are still not fully satisfied with your provisional grade, the matter can be pursued in line with the College Appeals Policy.

Stage 1

- 1. If you disagree with the assessment decision you must explain the reason, in writing, as soon as possible.
- 2. The tutor must consider this and provide you with a response e.g.:
 - Clear explanation of the assessment decision following re-evaluation of the evidence, or
 - If appropriate, amendment of the assessment record.

If you agree with the decision then the Appeal does not need to progress further but if you remain unhappy with the decision reached, the Appeal must proceed to Stage 2.

Stage 2

The tutor will pass all of the relevant information to an appropriate curriculum specialist via the moderation procedure, which will examine all the issues and evaluate the original decision. If you are still unhappy with this decision you can go to Stage 3.

Stage 3

Within 10 working days of the decision from Stage 2 your work will be passed to an external manager who will consider your Appeal. The decision reached is final.

If necessary, the matter can be referred to the Awarding Organisation Pearson (<u>http://qualifications.pearson.com/en/contact-us/feedback-and-complaints.html#tab-</u> <u>LearnersPearson.com</u>.) and also, the Office of the Independent Adjudicator (OIA) <u>http://www.oiahe.org.uk</u>.

5.6 Complaints

Complaints Procedure

The Sheffield College is committed to providing a high quality, educational experience and aims to provide a supportive environment, responsive to any concerns raised by students. Students should feel able to make a complaint relating to the action, or lack of action, or about the standard of a service or facility provided to students of the College. The procedures are intended to ensure that all complaints are treated fairly and consistently and, wherever possible, to resolve the matter to the complainant's satisfaction. Full details of the Complaints Policy can be seen here, <u>https://www.sheffcol.ac.uk/about-us/terms-and-conditions</u> and click on *Complaints Policy*.

The College complaints procedure has two stages:

- 1. Informal stage resolving a concern through informal discussion
- 2. Formal stage resolving a concern through the formal complaints procedure, of which there are three possible stages

Full details of the two stages, and who to approach for help and advice, can be seen here <u>https://www.sheffcol.ac.uk/about-us/terms-and-conditions</u> and click on *Complaints Procedure*.

Informal Stage

Most concerns are straightforward and can be resolved quickly with staff directly involved without the need to complete and submit a complaint form. Therefore, in the first instance, having considered the responsibilities of both students and the College as detailed within the <u>Student Charter</u>, any concerns/issues should be discussed, informally, with the person concerned or another member of staff. For example, if your complaint concerns teaching/tutorial matters you may wish to talk to your tutor or other members of teaching staff. If your complaint is about a service, then you should talk to an appropriate member of staff from that service. You could also consider raising your concern via the student forums.

If you are not sure who to speak to, or you do not feel able to approach the person most directly involved, you can seek advice regarding this from your Tutor Mentor, Deputy Head of Department, or from the Students' Union which acts independently of the College. You can contact the Students' Union on 0114 2602188 or email to studentsunion@sheffcol.ac.uk or call into one of the reception areas to make an appointment. At this point managers may wish to speak to staff involved and also obtain further guidance from Human Resources.

If a satisfactory resolution is not found informally, students are entitled to proceed to the College's formal complaints procedure.

Formal Stage

Stage 1

You should complete a Registration of Complaint form, copies of which can be obtained from College reception areas, or you can complete the online form via the College website <u>http://www.sheffcol.ac.uk/About/Public-Documents/Complaints</u>. You can ask a member of staff for help to complete the form or ask a friend, parent, carer or a representative of the Students' Union to submit a complaint on your behalf but we would require written agreement from you.

In addition to personal details and other information on the form, you will need to provide:

- details of the complaint
- an explanation of the steps you have already taken to try to resolve the complaint informally and why the responses you have received are not satisfactory
- where applicable, the outcome you would like from your complaint
- any supporting evidence (ie, copies of emails, notes of meetings, references to procedures, handbooks etc).

It is important to keep a copy of the completed form and other documentation submitted for your own records. Completed complaint forms should be submitted to any campus reception area or by email to <u>collegecomplaints@sheffcol.ac.uk</u>.

Within 5 working days of receipt of your complaint form, you will receive an acknowledgement. Your complaint will be considered to determine that the complaints procedure is appropriate and if so, it will be referred to a senior member of staff who will manage your complaint, ensuring that necessary action is taken and monitoring it through to completion.

After a further 10 working days you will receive a letter informing you of the progress of your complaint. We aim to complete the enquiry and reach a conclusion within 30 working days of receipt of your complaint form. If this is not possible you will be informed of the progress made. Complaints identified as requiring particularly speedy resolution will receive special attention.

You may be invited to attend a meeting to consider your complaint. You may bring a friend or representative to support you and/or for assistance but they cannot be a professional employed to act on your behalf.

Matters raised in a formal complaint will remain confidential to those directly involved in the investigation (which includes any members of staff concerned). All staff and students who become aware of any of the issues involved in a formal complaint are required to keep this information confidential (except as is necessary to progress, investigate or respond to the complaint). Failure to do so may result in formal disciplinary action being taken. However, there may be occasions when it is not possible to maintain

confidentiality, for example if another person is at risk. In such cases the situation will be explained to the complainant and/or the representative.

If your complaint is upheld you will be informed how and when any resolution or redress will be implemented. If the complaint is not upheld you can expect to receive clear reasons why this decision has been reached and advice on further action available to you including a review of the process of the complaint by the awarding body where appropriate (see Stage 2 below).

Stage 2

If you are not satisfied with the outcome of Stage 1, you can write to the Chief Executive, within 10 working days of receipt of the letter informing you of the outcome, to apply for a review of the process by the awarding/validating organisation. You should state the reason(s) why you are dissatisfied. Correspondence should be sent to the Chief Executive, c/o PA to the Chief Executive, Sheffield College, Granville Road, Sheffield S2 2RL.

Within 10 working days of receipt of your letter you will be informed of the action to be taken to review your complaint and any action you may need to take directly with the awarding/validating organisation.

Feedback

In accordance with the Student Charter, at the end of the two formal stages, you will be invited to complete a short evaluation of the process.

Stage 3

Following the action taken at Stage 2 (and not before), if you still feel that the matter has not been resolved to your satisfaction, having exhausted the College's procedures you may wish to contact Pearson, the Awarding Organisation, to refer the matter further. <u>https://qualifications.pearson.com/en/contact-us/feedback-and-complaints.html</u> If not resolved to the complainant's satisfaction, Higher Education students can apply for a review of their complaint to The Office of the Independent Adjudicator for Higher Education (OIA) http://www.oiahe.org.uk

5.7 Marking Arrangements

When you are set coursework, you will be given the deadline by which it is to be submitted. It is vital that you ensure you know the date, time and place for submission of coursework. Failure to meet a deadline counts as non-submission, and has serious repercussions.

It is your responsibility to keep a copy of all written coursework submitted. Your work will be marked by the unit tutor, and a sample will be internally verified by another member of staff. In addition, the Standards Verifier will sample work from all units.

You will receive feedback and marks for your work within 3 working weeks of submission. If for any reason this is not possible, you will be informed of the reason and given a date when work will be returned. The feedback you receive will be both written and oral, and forms a vital part of the learning process. Do make sure that you fully understand the feedback given, so that you can use it to improve your future work. Do not hesitate to ask the tutor if you need further guidance and explanation of your marks.

Please note that any marks you receive as part of the feedback process are provisional until confirmed by the Standards Verifier at a Review Board.

5.8 Guidance on Referencing

Accurate and consistent referencing is essential in all academic work. Whenever you refer to either the work or ideas of someone, or are influenced by another's work, you must acknowledge this. Similarly if you make a direct quotation from someone's work this should be referred to accurately.

There are a number of systems of referencing. The system you will use on this course is called the Harvard System. This system is described in the guides which can be found via the link below.

http://lcdatastore.shu.ac.uk/RefGuideV7.pdf

Referencing is a skill which improves with practice. It is a very important part of your academic development. The guides are comprehensive and explain how to reference any information source. Your tutor will give you feedback on your referencing in assignments to help you develop your referencing skills.

5.9 Notification of Results

At the end of each semester there will be a Review Board, which is chaired by the Head of HE and Access at the College, and attended by the HE Curriculum Leader and unit tutors from your course. The Standards Verifier is often, but not always present also. Whether or not the Standards Verifier attends the Board they will have reviewed samples of your assessed work.

These Review Boards consider your marks and confirm whether or not you have passed each unit, or whether you are awarded the Higher National Certificate. The Sheffield College University Centre normally sends out results letters within 2 weeks of the Review Board meeting.

Further information regarding Review Boards can been seen here, <u>https://www.sheffcol.ac.uk/about-us/terms-and-conditions</u> and click on *Review Boards Policy & Procedure*.

5.10 Provision of Certificates and Diploma Supplements

On successful completion of the course, your results are submitted to Pearson, who will issue your Certificate to the college. It is vital that you ensure TSC University Centre always has your current address so that these important documents go to the correct address.

You must notify TSC University Centre if you change either your term time or the permanent address given at enrolment.

5.11 Graduation

During the summer following successful completion of your course you will receive an invitation to attend our graduation ceremony. This is a memorable occasion where family and friends join you and your tutors to celebrate your achievements. Our media students usually film this event to capture the moment when, wearing your cap and gown, you shake hands with the guest speaker and receive your scroll. They film interviews with students and tutors. The college photographer also takes group shots of graduates. The resultant DVD is sent to all those attending graduation. The ceremony takes place in the autumn following successful completion of your course. Invitations to the ceremony will be sent out during the autumn following completion of your programme.

6. Learning Resources

All college campuses provide Wi-Fi access so that you can connect your own devices. There are drop in sessions at all college campuses to help you if you experience difficulties.

6.1 Access to College Resources

Learning Resource Centres (LRCs) provide open access to resources, study space and computing facilities, in a pleasant and welcoming environment. You will find a Learning Resource Centre located at all of the College campuses – Hillsborough, Peaks and Sheffield City College. Opening times can be found on the college website, in our information leaflets, and are displayed in each centre, as well as 24/7 electronic access where available.

It is our aim to make the LRC a flexible service, giving support throughout your time in college. Regular Student Forum meetings are held, where we welcome feedback and suggestions from students in order to improve our service.

LRCs provide you with an extensive range of resources to support your learning, including:

- Books, magazines and newspapers
- DVDs, multimedia, online and electronic resources
- Study support materials and learning packages
- Internet access, including Wi-Fi to connect your own device. Secure access to online resources is provided through an authentication service (currently Shibboleth) and the college VLE / Moodle found via the link http://vle.sheffcol.ac.uk/moodle/course/view.php?id=3913
- Resources can be produced in alternative formats and equipment can be loaned to make the most of mobile learning technologies.

You will be able to borrow many of these resources but others are available only for use in the LRC. Equipment is provided where necessary so that you can access the resources e.g. DVD players and computers.

In each LRC we have dedicated staff available to support students' learning needs:

- Study Assistants are available during working hours for face to face support, and questions can be sent via email to be answered by the next available assistant.
- Study Assistants also offer small group workshops on particular study skills for example: referencing; researching a subject; effective internet searching, etc.
- Staff are appropriately trained and keep up to date by attending regular updating sessions.

The LRC staff can help you with your study and research skills, and have specialist knowledge of the resources available in your subject area. The team can provide training in a range of library related information skills to enable you to use resources effectively to support your studies. During induction you will be given a tour of the facilities and have the opportunity to meet the staff.

Your access to the College's IT facilities is by means of a Student Account. Full-time students will create this as part of induction; part-time students should do this on their first visit to the LRC. Students are given a small starting balance on their printing and photocopying account. When that has been used, further credits can be purchased.

You can pre-book a computer to work on at any of the LRCs, so that you know a PC will be available when you need it.

The <u>library catalogue</u> and details of all the services offered are available from all college LRCs, or online in the LRC sections of the <u>college website</u>.

All students of the Sheffield College can borrow from any campus LRC. In order to borrow resources, students must bring their student card to the issue desk. Students are required to show their student card to gain access to College campuses.

Each student can borrow a total of up to 10 items, which may include:

Type of Loan	No. of items	Loan Terms
Ordinary Loan	Up to 10 items	3 Weeks
Short Loan	Up to 5 items	1 Week
Reference	Discretionary	Discretionary

The loan period is designated depending on the nature of resource and likely demand. The loan period may be changed following consultation with colleagues, or in periods of high demand.

Ordinary and short loan items can be renewed once, either by calling in to the LRC, by email, or by telephone. Reserved and overdue items will not be renewed.

Fines are charged for overdue items. Costs for lost or damaged items are the full cost of replacement, or is negotiable if the advertised price is not available.

Students can reserve items that are on loan to somebody else at the issue desk. If a resource is not available at their own centre, LRC staff can request it from another centre. This may take up to 5 working days. If your request cannot be satisfied within the college LRCs, we have access to a range of inter-library loan schemes, including links with the British Library.

The Learning Resource Centre Charter

We are here to help you be successful students - this is what we do for you:

Each working day we can give you:

- A welcoming place to study
- A wide range of books, journals, audio-visual materials and online resources relevant to your subject or course, most of which you are able to borrow
- A range of subject and study guides to support your learning
- Information Assistants to help you with your enquiries and information needs
- Study Assistants to help with your course work and IT enquiries
- Computers for you to use for your college work
- Wi-fi access for you to connect your own learning devices
- Photocopiers, printers and a range of learning equipment for you to use
- Access to all Sheffield College Learning Resource Centres to use their facilities
- Help in finding resources kept in other Libraries and Information Services

When you are not in college you can access many of our services 24/7:

- You can log in to our online services using your college user name and password
- You can email queries to us, to be answered when we are next working
- Our online catalogue helps you find resources in advance of your next visit
- We have a growing collection of e-books and e-journals for your course
- You can find our useful information guides through your Moodle/Google classroom VLE site

In return, this is what you can do for us:

- Ask us for any help that you need
- Take anything you want to borrow to the LRC desk with your Student ID Card
- Take care of any resources you use or borrow, and return them on time so they are available for other students to use
- Pay for any loss or damage caused to resources or facilities in your care, and the fines due on any items you didn't return on time
- Use the computers for course work only so they can be used by others too
- Respect the needs of other students and staff by keeping noise to a minimum for a pleasant and peaceful working atmosphere
- Use the LRC as a learning place please don't bring food or drinks in
- Help us contribute to the environment by not wasting resources
- Tell us if you have any ideas on how we can improve our services

We aim to provide an efficient and effective LRC service. Your suggestions and comments are welcome.

7. Opportunities to Engage in Quality Assurance of the Course

7.1 Student Representation

Students are invited to send representatives to attend Course Committees, where issues relating to the running and development of the course are discussed by teaching teams. At these meetings students can raise any concerns they have, so that prompt action can be taken to resolve matters. In addition, your personal tutor will discuss any concerns which arise during group tutorials, and report back on action taken. Student representatives are also invited to attend the course review at the end of each academic year.

The college employs a Student Involvement Facilitator, who calls termly meetings of the HE Student Forum, to which you are invited to send representatives. The Forum discusses noncourse issues which are then raised with the appropriate college manager, who provides feedback to the next meeting. The Student Forum elects a lead Student Representative, who represents the student voice at the HE Strategy Group (consisting of senior managers and directors). The HE Student Forum is invited to make a submission for the Higher Education Review (HER) conducted by the Quality Assurance Agency (QAA). This submission helps the review team to understand what it is like to be a student at the College. There is a brief guide to student involvement in HER, and the role of the Lead Student Representative on this section of the <u>QAA website</u>.

Higher Education students elect a representative to sit on the Student Union.

7.2 Student Surveys

The National Student Survey is conducted in your last year of study, where you are asked to respond to a series of questions about the quality of teaching and learning on your course. During your first year we will also ask you to complete short surveys to help us with particular aspects of your experience e.g. induction. In addition, you are asked to contribute to unit evaluations at the end of each unit in order to help us to continuously improve. The results of these surveys are fed into the Annual Review process, and action plans are devised which take account of student opinion. You will receive feedback on the action arising from these surveys through your representatives on course committees and your personal tutor during group tutorials.

7.3 Complaints Process

Definition

A complaint is an expression of concern or dissatisfaction with any aspect of the College's provision that requires a response. Complaints concerning assessment and accreditation may sometimes be dealt with through the college Appeals procedures and those set up by awarding/validating organisations.

- For further details of the Appeals procedure, please see paragraph 5.5 of this handbook.
- For further details of the Complaints procedure, please see paragraph 5.6 of this handbook.

8. Opportunities for Further Study

8.1 Opportunities at the Sheffield College

Details of courses suitable for Higher National graduates, including professional courses, can be found in the online HE prospectus, <u>https://www.sheffcol.ac.uk/courses/he-professional-guide</u>

If you are uncertain about what you need to study next to progress your career, you should book an interview with one of our careers guidance staff at student services reception.

8.2 Other Opportunities

You can apply to 'top up' your Higher National to an honours degree at any university offering the course. You should research their entry requirements via the UCAS and university websites, where you will also find details of the application process; some courses will require you to apply through UCAS, whilst others may ask you to apply direct to the institution. Student services hold hard copy prospectuses.

If you are a full time student, you may also consider going directly into employment, in which case you should book a careers interview to discuss the opportunities for trainee graduate and internship positions. Careers advisors can also help you with your job search and recommend sources of information such as graduate recruitment fairs.

9. Units of Study

LEVEL 4 CORE/MANDATORY UNITS

Unit 1:	Engineering	Design
	<u> </u>	

Unit code: K/615/1475 **Level:** 4

Credit value: 15

Introduction

The tremendous possibilities of the techniques and processes developed by engineers can only be realised by great design. Design turns an idea into a useful artefact, the problem into a solution, or something ugly and inefficient into an elegant, desirable and cost effective everyday object. Without a sound understanding of the design process the engineer works in isolation without the links between theory and the needs of the end user.

The aim of this unit is to introduce students to the methodical steps that engineers use in creating functional products and processes; from a design brief to the work, and the stages involved in identifying and justifying a solution to a given engineering need.

Among the topics included in this unit are: Gantt charts and critical path analysis, stakeholder requirements, market analysis, design process management, modelling and prototyping, manufacturability, reliability life cycle, safety and risk, management, calculations, drawings and concepts and ergonomics.

On successful completion of this unit students will be able to prepare an engineering design specification that satisfies stakeholders' requirements, implement best practice when analysing and evaluating possible design solutions, prepare a written technical design report, and present their finalised design to a customer or audience.

Learning outcomes

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

- 1. Plan a design solution and prepare an engineering design specification in response to a stakeholder's design brief and requirements.
- 2. Formulate possible technical solutions to address the student-prepared design specification.
- 3. Prepare an industry-standard engineering technical design report.
- 4. Present to an audience a design solution based on the design report and evaluate the solution/presentation.

LO1 Plan a design solution and prepare an engineering design specification in response to a stakeholder's design brief and requirements

Planning techniques used to prepare a design specification: Definition of client's/users objectives, needs and constraints Definition of design constraints, function, specification, milestones Planning the design task: Flow charts, Gantt charts, network and critical path analysis necessary in the design process Use of relevant technical/engineering/industry standards within the design process

Design process:

Process development, steps to consider from start to finish The cycle from design to manufacture Three- and five-stage design process Vocabulary used in engineering design

Stage of the design process which includes:

Analysing the situation, problem statement, define tasks and outputs, create the design concept, research the problem and write a specification Suggest possible solutions, select a preferred solution, prepare working drawings, construct a prototype, test and evaluate the design against objectives, design communication (write a report)

Customer/stakeholder requirements: Converting customer request to a list of objectives and constraints Interpretation of design requirements Market analysis of existing products and competitors Aspects of innovation and performance management in decision-making

LO2 Formulate possible technical solutions to address the student-prepared design specification

Conceptual design and evaluating possible solutions: Modelling, prototyping and simulation using industry standard software, (e.g. AutoCAD, Catia, SolidWorks, Creo) on high specification computers Use of evaluation and analytical tools, e.g. cause and effect diagrams, CAD, knowledge-based engineering

LO3 Prepare an industry-standard engineering technical design report

Managing the design process:

Recognising limitations including cost, physical processes, availability of material/components and skills, timing and scheduling

Working to specifications and standards, including: The role of compliance checking, feasibility assessment and commercial viability of product design through testing and validation

Design for testing, including:

Material selection to suit selected processes and technologies Consideration of manufacturability, reliability, life cycle and environmental issues The importance of safety, risk management and ergonomics

Conceptual design and effective tools:

Technologies and manufacturing processes used in order to transfer engineering designs into finished products

LO4 Present to an audience a design solution based on the design report and evaluate the solution/presentation

Communication and post-presentation review: Selection of presentation tools Analysis of presentation feedback Strategies for improvement based on feedback

Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
LO1 Plan a design solution an	d prepare an engineering	D1 Compare and
design specification in response	contrast the completed design specification	
brief and requirements		
P1 Produce a design	M1 Evaluate potential	against the relevant
specification from a	planning techniques,	industry standard
given design brief	presenting a case for the	specification
P2 Explain the influence of	method chosen	
the stakeholder's	M2 Demonstrate critical path	
design brief and	analysis techniques in design	
requirements in the	project scheduling/planning	
preparation of the	and explain its use	
design specification		
P3 Produce a design		
project schedule with a		
graphical illustration of the		
planned activities		
LO2 Formulate possible techn	ical solutions to address the	D2 Evaluate potential
student-prepared design spec	ification	technical solutions,
P4 Explore industry	M3 Apply the principles of	presenting a case for
standard evaluation and	modelling/simulation/	the final choice of
analytical tools in	prototyping, using	solution
formulating possible	appropriate software, to	
technical solutions	develop appropriate design	
P5 Use appropriate	solutions	
design techniques to		
produce possible design		
LO2 Proparo an industry stan	hard onginooring tochnical	D2 Evaluato the
design report	dard engineering technical	effectiveness of the
P6 Prepare an industry-	M4 Explain the role of design	presented industry-
standard engineering	specifications and standards	standard
technical design report	in producing a finished	engineering
P7 Assess the	product	technical design report
presented technical	M5 Identify any compliance,	for producing a fully
design and identify any	safety and risk management	compliant finished
potential limitations it	issues present in the chosen	product
may have	solution	
LO4 Present to an audience a	design solution based on the	D4 Justify potential
design report and evaluate th	improvements to the	
P8 Present the	M6 Reflect on effectiveness of	presented design
recommended design	communication strategy in	solution, based on
solution to the identified	presenting the solution	reflection and/or
audience		feedback obtained from
P9 Explain possible		the presentation
communication		
strategies and		
presentation methods		
that could be used to		
inform the stakeholders		
of the recommended		
solution		

Textbooks

DUL, J. and WEERDMEESTER, B. (2008) *Ergonomics for beginners*. 3rd Ed. Boca Raton: CRC Press.

DYM, C.L., LITTLE, P. and ORWIN, E. (2014) *Engineering Design: a Project Based Introduction*. 4th Ed. Wiley.

GRIFFITHS, B. (2003) Engineering Drawing for Manufacture. Kogan Page Science.

REDDY, K.V. (2008) *Textbook of Engineering Drawing*. 2nd Ed. Hyderabad: BS Publications.

Websites

www.epsrc.ac.uk	Engineering and Physical Sciences Research Council (General Reference)
www.imeche.org	Institution of Mechanical Engineers (General Reference)

Links

This unit links to the following related units: Unit 23: Computer Aided Design and Manufacture (CAD/CAM) Unit 34: Research Project
 Unit code:
 M/615/1476

 Level:
 4

 Credit value:
 15

Introduction

The mathematics that is delivered in this unit is that which is directly applicable to the engineering industry, and it will help to increase students' knowledge of the broad underlying principles within this discipline.

The aim of this unit is to develop students' skills in the mathematical principles and theories that underpin the engineering curriculum. Students will be introduced to mathematical methods and statistical techniques in order to analyse and solve problems within an engineering context.

On successful completion of this unit students will be able to employ mathematical methods within a variety of contextualised examples, interpret data using statistical techniques, and use analytical and computational methods to evaluate and solve engineering problems.

Learning outcomes

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

- 1. Identify the relevance of mathematical methods to a variety of conceptualised engineering examples.
- 2. Investigate applications of statistical techniques to interpret, organise and present data by using appropriate computer software packages.
- 3. Use analytical and computational methods for solving problems by relating sinusoidal wave and vector functions to their respective engineering applications.
- 4. Examine how differential and integral calculus can be used to solve engineering problems.

LO1 Identify the relevance of mathematical methods to a variety of conceptualised engineering examples

Mathematical concepts: Dimensional analysis Arithmetic and geometric progressions

Functions: Exponential, logarithmic, circular and hyperbolic functions

LO2 Investigate applications of statistical techniques to interpret, organise and present data, by using appropriate computer software packages

Summary of data: Mean and standard deviation of grouped data Pearson's correlation coefficient Linear regression

Probability theory: Binomial and normal distribution

LO3 Use analytical and computational methods for solving problems by relating sinusoidal wave and vector functions to their respective engineering application.

Sinusoidal waves: Sine waves and their applications Trigonometric and hyperbolic identities

Vector functions: Vector notation and properties Representing quantities in vector form Vectors in three dimensions

LO4 Examine how differential and integral calculus can be used to solve engineering problems

Differential calculus:

Definitions and concepts

Definition of a function and of a derivative, graphical representation of a function, notation of derivatives, limits and continuity, derivatives; rates of change, increasing and decreasing functions and turning points

Differentiation of functions

Differentiation of functions including:

- standard functions/results
- using the chain, product and quotient rules
- second order and higher derivatives

Types of function: polynomial, logarithmic, exponential and trigonometric (sine, cosine and tangent), inverse trigonometric and hyperbolic functions

Integral calculus:

Definite and indefinite integration

Integrating to determine area

Integration of common/standard functions and by substitution and parts

Exponential growth and decay

Types of function: algebraic including partial fractions and trigonometric (sine, cosine and tangent) functions

Engineering problems involving calculus:

Including: stress and strain, torsion, motion, dynamic systems, oscillating systems, force systems, heat energy and thermodynamic systems, fluid flow, AC theory, electrical signals, information systems, transmission systems, electrical machines, electronics

Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
LO1 Identify the relevance of	LO1 & 2	
variety of conceptualised eng		
P1 Apply dimensional	M1 Use dimensional analysis	D1 Present
analysis techniques to solve	to derive equations	statistical data in a
complex problems		method that can be
P2 Generate answers from		understood by a
contextualised arithmetic		non-technical
and geometric progressions		audience
P3 Determine solutions of		
equations using exponential,		
trigonometric and hyperbolic		
Tunctions	of statistical tashniques to	-
LO2 Investigate applications	or statistical techniques to	
computer software packages	it data by using appropriate	
PI Summarise data by	M2 Interpret the results	
calculating mean and	of a statistical hypothesis	
standard deviation and	test conducted from a	
simplify data into graphical	given scenario	
form	given scenario	
P5 Calculate probabilities		
within both binomially		
distributed and normally		
distributed random variables		
LO3 Use analytical and compu	Itational methods for solving	D2 Model the
problems by relating sinusoid	al wave and vector functions to	combination of sine
their respective engineering a	pplication	waves graphically and
P6 Solve engineering	M3 Use compound angle	analyse the variation in
problems relating to	identities to separate waves	results between graphical
sinusoidal functions	into distinct component	and analytical methods
P7 Represent engineering	waves	
quantities in vector form,		
and use appropriate		
methodology to determine		
engineering parameters		
LU4 Examine now differential and integral calculus can be		D3 Analyse maxima
Used to solve engineering problems		and minima of increasing
P8 Determine rates of	of exponential growth and	and decreasing functions
logarithmic and circular	decay models using	using higher order
functions	integration methods	derivatives
P9 Use integral calculus to		
solve practical problems		
relating to engineering		

Recommended Resources

Textbooks

SINGH, K. (2011) *Engineering Mathematics Through Applications*. 2nd Ed. Basingstoke: Palgrave Macmillan.

STROUD, K.A. and BOOTH, D.J. (2013) *Engineering Mathematics*. 7th Ed. Basingstoke: Palgrave Macmillan.

(Tutorials)

Websites

http://www.mathcentre.ac.uk/ Maths Centre (Tutorials)

Links

This unit links to the following related units: *Unit 39: Further Mathematics* **Unit code:** T/615/1477

Level: 4

Credit value: 15

Introduction

Engineering is a discipline that uses scientific theory to design, develop or maintain structures, machines, systems, and processes. Engineers are therefore required to have a broad knowledge of the science that is applicable to the industry around them.

This unit introduces students to the fundamental laws and applications of the physical sciences within engineering and how to apply this knowledge to find solutions to a variety of engineering problems.

Among the topics included in this unit are: international system of units, interpreting data, static and dynamic forces, fluid mechanics and thermodynamics, material properties and failure, and A.C./D.C. circuit theories.

On successful completion of this unit students will be able to interpret and present qualitative and quantitative data using computer software, calculate unknown parameters within mechanical systems, explain a variety of material properties and use electromagnetic theory in an applied context.

Learning outcomes

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

- 1. Examine scientific data using both quantitative and computational methods.
- 2. Determine parameters within mechanical engineering systems.
- 3. Explore the characteristics and properties of engineering materials.
- 4. Analyse applications of A.C./D.C. circuit theorems, electromagnetic principles and properties.

Essential content

LO1 Examine scientific data using both quantitative and computational methods

International system of units:

The basic dimensions in the physical world and the corresponding SI base units SI derived units with special names and symbols

SI prefixes and their representation with engineering notation

Interpreting data:

Investigation using the scientific method to gather appropriate data Test procedures for physical (destructive and non-destructive) tests and statistical tests that might be used in gathering information Summarising quantitative and qualitative data with appropriate graphical representations Using presentation software to present data to an audience

LO2 Determine parameters within mechanical engineering systems

Static and dynamic forces:

Representing loaded components with space and free body diagrams Calculating support reactions of objects subjected to concentrated and distributed loads

Newton's laws of motion, D'Alembert's principle and the principle of conservation of energy

Fluid mechanics and thermodynamics: Archimedes' principle and hydrostatics Continuity of volume and mass flow for an incompressible fluid Effects of sensible/latent heat of fluid Heat transfer due to temperature change and the thermodynamic process equations

LO3 Explore the characteristics and properties of engineering materials

Material properties:

Atomic structure of materials and the structure of metals, plastics and composites Mechanical and electromagnetic properties of materials

Material failure:

Destructive and non-destructive testing of materials The effects of gradual and impact loading on a material. Degradation of materials and hysteresis

LO4 Analyse applications of A.C./D.C. circuit theorems, electromagnetic principles and properties

D.C. circuit theory:

Voltage, current and resistance in D.C. networks Exploring circuit theorems (Thevenin, Norton, Superposition), Ohm's law and Kirchhoff's voltage and current laws A.C. circuit theory: Waveform characteristics in a single-phase A.C. circuit RLC circuits

Magnetism:

Characteristics of magnetic fields and electromagnetic force The principles and applications of electromagnetic induction
LO1 Examine scientific data using both quantitative D1 Present an analysis o		
	LO1 Examine scientific data using both quantitative	
and computational methods scientific data using both	and computational methods	
P1 Describe SI units and M1 Explain how the computational and	P1 Describe SI units and	
prefix notation application of scientific qualitative methods	prefix notation	
P2 Examine quantitative method impacts upon	P2 Examine quantitative	
and qualitative data with different test	and qualitative data with	
appropriate graphical procedures	appropriate graphical	
representations	representations	
LO2 Determine parameters within mechanicalD2 Critically compare	LO2 Determine parameters w	
engineering systems how changes in the	engineering systems	
P3 Determine the support M2 Determine unknown forces thermal efficiency of a	P3 Determine the support	
reactions of a beam carrying by applying d'Alembert's heat transfer process car	reactions of a beam carrying	
a concentrated load and a principle to a free body affect the behavioural	a concentrated load and a	
uniformly distributed load diagram characteristics of a	uniformly distributed load	
P4 Use Archimedes' principle mechanical systems	P4 Use Archimedes' principle	
in contextual engineering	in contextual engineering	
applications	applications	
P5 Determine through	P5 Determine through	
practical examples the	practical examples the	
change within a solid	change within a solid	
material when exposed to	material when exposed to	
temperature variations	temperature variations	
LO3 Explore the characteristics and properties of D3 Compare and contrast	LO3 Explore the characteristic	
engineering materials theoretical material	engineering materials	
P6 Describe the structural M3 Review elastic, properties of metal and	P6 Describe the structural	
properties of metals and electrical and magnetic non-metallic materials	properties of metals and	
non-metals with reference hysteresis in different compared with values	non-metals with reference	
to their material properties materials obtained through	to their material properties	
P7 Explain the types of destructive and non-	P7 Explain the types of	
degradation found in destructive test methods	degradation found in	
metals and non-metals	metals and non-metals	
LO4 Analyse applications of A.C./D.C. circuit	LO4 Analyse applications of A.	
Received a solve problems on the principles and properties and the solve problems on	Re Calculate aurrente and	
voltages in circuite using annual annual contract of annual contract of the principles and the series parallel D L C	Fo Calculate currents and	
voltages in circuits using applications of series-parallel R, L, C	circuit theorems	
Describe how complex	Describe how complex	
wayos aro producod from	wayos aro produced from	
sinusoidal wavoforms	sinusoidal waveforms	
P10 Solve problems on	P10 Solve problems on	
series P. L. C circuits with	sories P I C circuits with	
A C. theory	$A \cap A$	

Recommended Resources

Textbooks

BIRD, J. (2012) Science for Engineering. 4th Ed. London: Routledge.

BOLTON, W. (2006) Engineering Science. 5th Ed. London: Routledge.

TOOLEY, M. and DINGLE, L. (2012) *Engineering Science: For Foundation Degree and Higher National*. London: Routledge.

Journals

International Journal of Engineering Science. International Journal of Engineering Science and Innovative Technology.

Websites

https://www.khanacademy.org/

Khan Academy Physics (Tutorials)

Links

This unit links to the following related units: Unit 9: Materials, Properties and Testing Unit 3: Engineering Science **Unit code:** A/615/1478

Level: 4

Credit value: 15

Introduction

The responsibilities of the engineer go far beyond completing the task in hand. Reflecting on their role in a wider ethical, environmental and sustainability context starts the process of becoming a professional engineer – a vial requirement for career progression.

Engineers seldom work in isolation and most tasks they undertake require a range of expertise, designing, developing, manufacturing, constructing, operating and maintaining the physical infrastructure and content of our world. The bringing together of these skills, expertise and experience is often managed through the creation of a project.

This unit introduces students to the techniques and best practices required to successfully create and manage an engineering project designed to identify a solution to an engineering need. While carrying out this project students will consider the role and function of engineering in our society, the professional duties and responsibilities expected of engineers together with the behaviours that accompany their actions.

Among the topics covered in this unit are: roles, responsibilities and behaviours of a professional engineer, planning a project, project management stages, devising solutions, theories and calculations, management using a Gantt chart, evaluation techniques, communication skills, and the creation and presentation of a project report.

On successful completion of this unit students will be able to conceive, plan, develop and execute a successful engineering project, and produce and present a project report outlining and reflecting on the outcomes of each of the project processes and stages. As a result, they will develop skills such as critical thinking, analysis, reasoning, interpretation, decision-making, information literacy, and information and communication technology, and skills in professional and confident self-presentation.

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

Learning outcomes

- 1. Formulate and plan a project that will provide a solution to an identified engineering problem.
- 2. Conduct planned project activities to generate outcomes which provide a solution to the identified engineering problem.
- 3. Produce a project report analysing the outcomes of each of the project processes and stages.
- 4. Present the project report drawing conclusions on the outcomes of the project.

Essential content

LO1 Formulate and plan a project that will provide a solution to an identified engineering problem

Examples of realistic engineering based problems: Crucial considerations for the project How to identify the nature of the problem through vigorous research Feasibility study to identify constraints and produce an outline specification

Develop an outline project brief and design specification: Knowledge theories, calculations and other relevant information that can support the development of a potential solution

Ethical frameworks:

The Engineering Council and Royal Academy of Engineering's Statement of Ethical Principles

The National Society for Professional Engineers' Code of Ethics

Regulatory bodies:

Global, European and national influences on engineering and the role of the engineer, in particular: The Royal Academy of Engineering and the UK Engineering Council

The role and responsibilities of the UK Engineering Council and the Professional Engineering Institutions (PEIs)

The content of the UK Standard for Professional Engineering Competence (UKSPEC)

Chartered Engineer, Incorporated Engineer and Engineering Technician

International regulatory regimes and agreements associated with professional engineering:

European Federation of International Engineering Institutions. European Engineer (Eur Eng) European Network for Accreditation of Engineering Education European Society for Engineering Education Washington Accord Dublin Accord Sydney Accord International Engineers Alliance Asia Pacific Economic Cooperation (APEC) Engineers Agreement

LO2 Conduct planned project activities to generate outcomes which provide a solution to the identified engineering problem

Project execution phase:

Continually monitoring development against the agreed project plan and adapt the project plan where appropriate

Work plan and time management, using Gantt chart or similar.

Tracking costs and timescales

Maintaining a project diary to monitor progress against milestones and timescales

Engineering professional behaviour sources:

Professional responsibility for health and safety (UK-SPEC) Professional standards of behaviour (UK-SPEC) Ethical frameworks:

The Engineering Council and Royal Academy of Engineering's Statement of Ethical Principles The National Society for Professional Engineers' Code of Ethics

LO3 **Produce a project report analysing the outcomes of each of the project processes and stages**

Convincing arguments:

All findings/outcomes should be convincing and presented logically where the assumption is that the audience has little or no knowledge of the project process

Critical analysis and evaluation techniques:

Most appropriate evaluation techniques to achieve a potential solution

Secondary and primary data should be critiqued and considered with an objective mindset

Objectivity results in more robust evaluations where an analysis justifies a Judgement

LO4 Present the project report drawing conclusions on the outcomes of the project

Presentation considerations:

Media selection, what to include in the presentation and what outcomes to expect from it. Audience expectations and contributions

Presentation specifics. Who to invite: project supervisors, fellow students and employers. Time allocation, structure of presentation

Reflection on project outcomes and audience reactions

Conclusion to report, recommendations for future work, lessons learned, changes to own work patterns

Reflection for learning and practice:

The difference between reflecting on performance and evaluating a project – the former considers the research process, information gathering and data collection, the latter the quality of the research argument and use of evidence

The cycle of reflection:

To include reflection in action and reflection on action

How to use reflection to inform future behaviour, particularly directed towards sustainable performance

The importance of Continuing Professional Development (CPD) in refining ongoing professional practice

Reflective writing:

Avoiding generalisation and focusing on personal development and the research journey in a critical and objective way

Pass	Merit	Distinction
LO1 Formulate and plan a project that will provide a solution to an identified engineering problem		D1 Illustrate the effect of legislation and ethics in
 P1 Select an appropriate engineering based project, giving reasons for the selection P2 Create a project plan for the engineering project 	M1 Undertake a feasibility study to justify project selection	developing the project plan
LO2 Conduct planned project activities to generate outcomes which provide a solution to the identified engineering problem		D2 Critically evaluate the success of the project plan, making
P3 Conduct project activities, recording progress against original project plan	M2 Explore alternative methods to monitor and meet project milestones, justify selection of chosen method(s)	recommendations for improvements
LO3 Produce a project report analysing the outcomes of each of the project processes and stages		LO3 & LO4 D3 Critically analyse the
P4 Produce a project report covering each stage of the project and analysing project outcomes	M3 Use appropriate critical analysis and evaluation techniques to analyse project findings	project outcomes making recommendations for further development
LO4 Present the project repor	t drawing conclusions	
P5 Present the project	M4 Analyse own behaviours	
report using appropriate media to an audience	and performance during the project and suggest areas for improvement	

Recommended Resources

Textbooks

PUGH, P. S. (1990) *Total Design: Integrated Methods for Successful Product Engineering*. Prentice Hall.

STRIEBIG, B., OGUNDIPE, A. and PAPADAKIS, M. (2015) *Engineering Applications in Sustainable Design and Development*. Cengage Learning.

ULRICH, K. and EPPINGER, S. (2011) *Product Design and Development.* 5th Ed. McGraw-Hill Higher Education.

Journals

Journal of Engineering Design.

Links

This unit links to the following related units:

Unit 34: Research Project

Unit 35: Professional Engineering Management

Unit code: H/615/1488

Level: 4

Credit value: 15

Introduction

All of the manufactured products we use in our daily lives, from processed food to clothing and cars, are the result of production engineering. Production engineers need to have a comprehensive knowledge and understanding of all the possible production technologies available, their advantages and disadvantages, the requirements of the production system operation and the interaction between the various components of the production system.

This unit introduces students to the production process for key material types; the various types of machinery used to manufacture products and the different ways of organising production systems to optimise the production process; consideration of how to measure the effectiveness of a production system within the overall context of the manufacturing system; and an examination of how production engineering contributes to ensuring safe and reliable operation of manufacturing.

On successful completion of this unit students will be able to illustrate the role and purpose of production engineering and its relationship with the other elements of a manufacturing system. They will be able to select the most appropriate production processes and associated facility arrangements for manufacturing products of different material types and design a production system incorporating a number of different production processes.

Learning outcomes

- 1. Illustrate the role and purpose of production engineering and its relationship with the other elements of a manufacturing system.
- 2. Select the most appropriate production processes and associated facility arrangements, for manufacturing products of different material types.
- 3. Analyse how a production system can incorporate a number of different production processes for a given product or assembly.
- 4. Explore the effectiveness of a production system in terms of its operation within the wider manufacturing system.

Essential content

LO1 Illustrate the role and purpose of production engineering and its relationship with the other elements of a manufacturing system

Production engineering activities:

Common practices for manufacturing

Research and develop tools, processes, machines, and equipment

Integrate facilities and systems for producing quality products

Design, implement and refine products, services, processes and systems

Combination of manufacturing technology and management science

LO2 Select the most appropriate production processes and associated facility arrangements, for manufacturing products of different material types

Production processes:

Common ceramics, composite, metals manufacturing processes

Bonding and jointing technologies, including welding, adhesives, snap fits, interference fits and mechanical assemblies

LO3 Analyse how a production system can incorporate a number of different production processes for a given product or assembly

Function of the range of production facilities within a manufacturing plant:

Production design for manufacture and assembly

Cellular and flexible manufacturing systems

Component production using CNC machining centres and automated production processes

Automated materials handling equipment, conveyor systems, automatic guided vehicle servicing, product assembly and production lines

Heat treatment facilities, paint and coating plants

Warehouse, stock storage equipment

The purpose, operation and effects of incorporating concepts such as lean manufacturing and just-in-time (JIT) supply to the production process

LO4 Explore the effectiveness of a production system in terms of its operation within the wider manufacturing system

Production systems:

Production performance criteria, through-put rates, yield rates, cost effectiveness, sustainability, flexibility and reliability

Optimising supply chain performance and management Essential collaboration between manufacturer, supplier and retailer *Production errors and rectification:* Cost in terms of time, material waste, product recall, reputation and litigation Production data collection, critical evaluation and analysis *The human component:* Cultural openness to new ideas and continuous improvement Collaboration and information sharing Performance management and rewards

Engineer training and development practices

LO1 Illustrate the role and purpose of production engineering and its relationship with the other elements of a manufacturing systemD1 Analyse how the production engineer supports the development of operational strategies to achieve production and financial objectivesP1 Describe the multiple elements of a modern manufacturing systemM1 Investigate how the production engineer can influence the design process and refine products, services and systemsD1 Analyse how the production engineer supports the development of operational strategies to achieve production and financial objectivesP2 Explain the role of the production engineer within a manufacturing systemM1 Investigate how the products, services and systemsD2 Evaluate how the choice of bonding and jointing processes influence both the products manufactured using the sintering, hot pressing, chemical vapour deposition (CVD) and reaction bonding processesM2 Discuss the benefits associated with polymer manufacturing processP4 Describe the properties and applications of composite products manufactured using manual and automated layup, filament winding, pultrusion and resin transfer moulding processesM3 Explain how materials, components and subassemblyD3 Analyse the relationship of just-in- time (JIT) and lean manufacturing and their effects on manufacturing and their effects on manufacturing product or assemblyP5 Review the type and sequence of production for initial design through to manufacture and distributionM3 Explain how materials, component sould follow from initial design through to manufacturing product or assemblyM3 Explain how materials, co	Pass	Merit	Distinction
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P5 Review the type and sequence of production processes a product or component would follow from initial design through to manufacture and distributionM3 Explain how materials, components and subassembly handling and conveyance can impact on the effectiveness and efficiency of a modern manufacturing plantmanufacturing to total quality and world-class manufacturing and their effects on production processes for a given product or assemblyP6 Describe the function of the various production facilities within a modern memotymanufacture and and efficiency of a modern manufacturing plantmanufacturing to total quality and world-class manufacturing and their effects on production processes for a given product or assembly	number of different productio	n processes for a given product	time (IIT) and lean
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processes a production handling and conveyance can impact on the effectiveness and efficiency of a modern manufacture and distribution P6 Describe the function of the various production facilities within a modern memory for turing and their effects on product or assembly	social so	Components and subassembly	quality and world-class
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to manufacture and distribution P6 Describe the function of the various production facilities within a modern	from initial design through	and efficiency of a modern	production processes
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P6 Describe the function of the various production facilities within a modern	distribution	51	assembly
the various production facilities within a modern	P6 Describe the function of		
facilities within a modern	the various production		
	facilities within a modern		
manufacturing plant D4 Analyze the criteria	manufacturing plant		D4 Amelyica the exiteria
LO4 Explore the effectiveness of a production system in	LO4 Explore the effectiveness	of a production system in	D4 Analyse the criteria
terms of its operation within the wider manufacturing	terms of its operation within the wider manufacturing		by which production
system performance call be measured within the	system		measured within the
P / Review the type of data M4 Explain the immediate wider manufacturing	P <i>i</i> Review the type of data	W4 Explain the immediate	wider manufacturing
that would be collected and and long term effects that system	that would be collected and	and long term effects that	system
analysed to measure production errors and production participation can have on a	analysed to measure	production errors and	
PR Describe the measures manufacturing company	PR Describe the measures	manufacturing company	
that can improve	that can improve		
production performance	production performance		
criteria	criteria		

Recommended Resources

Textbooks

KALPAKJIAN, S. and SCHMID, S. (2009) *Manufacturing Engineering and Technology*. 6th Ed. Prentice Hall.

Websites

https://www.khanacademy.org/

Khan Academy (Tutorials)

Links

This unit links to the following related units: Unit 23: Computer Aided Design and Manufacture (CAD/CAM) Unit 48: Manufacturing Systems Engineering **Unit code:** H/615/1491

Level: 4

Credit value: 15

Introduction

Quality has always been the key to business success and survivability, but it requires organisations to allocate a lot of effort and resources to achieve it. The key to providing quality services and designing top quality products lies in the strength and effectiveness of the processes used in their development; processes which must be constantly reviewed to ensure they operate as efficiently, economically and as safely as possible.

This unit introduces students to the importance of quality assurance processes in a manufacturing or service environment and the principles and theories that underpin them. Topics included in this unit are: tools and techniques used to support quality control, attributes and variables, testing processes, costing modules, the importance of qualifying the costs related to quality, international standards for management (ISO 9000, 14000, 18000), European Foundation for Quality Management (EFQM), principles, tools and techniques of Total Quality Management (TQM) and implementation of Six Sigma.

On successful completion of this unit students will be able to illustrate the processes and applications of statistical process, explain the quality control tools used to apply costing techniques, identify the standards expected in the engineering environment to improve efficiency and examine how the concept of Total Quality Management and continuous improvement underpins modern manufacturing and service environments.

Learning outcomes

- 1. Illustrate the applications of statistical process control when applied in an industrial environment to improve efficiency.
- 2. Analyse cost effective quality control tools.
- 3. Determine the role of standards in improving efficiency, meeting customer requirements and opening up new opportunities for trade.
- 4. Analyse the importance of Total Quality Management and continuous improvement in manufacturing environments.

LO1 Illustrate the applications of statistical process control when applied in an industrial environment to improve efficiency

Quality control:

The tools and techniques used to support quality control Attributes and variables Testing processes Quality tools and techniques, including SPC Designing quality into new products and processes using Quality Function Deployment (QFD)

LO2 Analyse cost effective quality control tools

Quality costing:

Costing modules The importance of qualifying the costs related to quality How costs can be used to improve business performance

LO3 Determine the role of standards in improving efficiency, meeting customer requirements and opening up new opportunities for trade

Standards for efficiency:

The history of standards

The role of standards and their importance in enabling and supporting trade and industry

Standards for measurement

International Standards for management (ISO 9000, 14000, 18000)

European Foundation for Quality Management (EFQM) as an aid to developing strategic competitive advantage

LO4 Analyse the importance of Total Quality Management and continuous improvement in manufacturing environments

Overview and function of quality:

The importance of quality to industry: how it underpins the ability to improve efficiency, meet customer requirements and improve competitiveness

Principles, tools and techniques of Total Quality Management (TQM)

Understanding and implementation of Six Sigma

Pass	Merit	Distinction
LO1 Illustrate the application: when applied in an industrial efficiency	s of statistical process control environment to improve	D1 Suggest justified recommendations for the application of statistical
 P1 Review the tools and techniques used to support quality control P2 Describe the processes and applications of statistical process control in industrial environments 	M1 Explain the role and effectiveness of the quality tools and techniques used within an industrial environment	process control in an industrial environment to improve efficiency
LO2 Analyse cost effective qu	ality control tools	D2 Develop a process
P3 Analyse the effective use of quality control tools and techniques P4 Analyse costing techniques used within industry	M2 Determine with justification the quality control tools and techniques that could be used to improve business performance	for the application of an extensive range of quality control tools and techniques with emphasis on costing
Industry	ndards in improving	D3 Illustrate a plan for
efficiency, meeting customer requirements and opening up new opportunities for trade		the application of international standards
P5 Determine required standards to improve efficiency, meet customer requirements and open up new opportunities for trade	M3 Discuss the importance of standards applied in the engineering environment	that would improve efficiency, meet customer requirements and open up new opportunities for trade
LO4 Analyse the importance of Total Quality Management and continuous improvement in manufacturing and service environments		D4 Analyse how the appropriate application
 P6 Analyse the principles, tools and techniques of Total Quality Management and continuous improvement P7 Analyse how the concept of Total Quality Management and continuous improvement could help in delivering high quality performance within businesses 	M4 Discuss how the appropriate application of Total Quality Management and continuous improvement in tools and techniques affect quality performance in the manufacturing and service environments	of Total Quality Management and continuous improvement in tools and techniques affect quality performance in the manufacturing and service environments

Textbooks

OAKLAND, J.S. (2003) *Total Quality Management: Text with Cases*. 3rd Ed. Butterworth-Heinemann.

SLACK, N., CHAMBERS, S. and JOHNSTON, R. (2016) *Operations Management*. 8th Ed. Essex: Pearson Education Limited.

Links

This unit links to the following related units: *Unit 49: Lean Manufacturing*

LEVEL 4 OPTIONAL UNITS

Unit 23: Computer Aided Design and Manufacture (CAD/CAM)

Unit code: J/615/1497

Level: 4

Credit value: 15

Introduction

The capacity to quickly produce finished components from a software model is now essential in the competitive world of manufacturing. Businesses now invest heavily in Computer Aided Design (CAD) software, Computer Aided Manufacture (CAM) software and Computer Numerical Control (CNC) machines to facilitate this, thus reducing product lead times. CAD gives design engineers the platform to creatively model components that meet the specific needs of the consumer. When these models are combined with CAM software, manufacturing is made a reality.

This unit introduces students to all the stages of the CAD/CAM process and to the process of modelling components using CAD software specifically suitable for transferring to CAM software. Among the topics included in this unit are: programming methods, component set-up, tooling, solid modelling, geometry manipulation, component drawing, importing solid model, manufacturing simulation, data transfer, CNC machine types and inspections.

On successful completion of this unit students will be able to illustrate the key principles of manufacturing using a CAD/CAM system; produce 3D solid models of a component suitable for transfer into a CAM system; use CAM software to generate manufacturing simulations of a component; and design a dimensionally accurate component on a CNC machine using a CAD/CAM system.

Learning outcomes

- 1. Describe the key principles of manufacturing using a CAD/CAM system.
- 2. Produce 3D solid models of a component suitable for transfer into a CAM system.
- 3. Use CAM software to generate manufacturing simulations of a component.
- 4. Design and produce a dimensionally accurate component on a CNC machine using a CAD/CAM system.

LO1 Describe the key principles of manufacturing using a CAD/CAM system

Hardware:

CAD workstation, printers, USB flash drives and network cables

Software:

Operating systems, hard disk requirements, processor, CAD software e.g. SolidWorks, Autodesk Inventor, CATIA; CAM software e.g. Edgecam, Delcam, GibbsCAM, SolidCAM

Inputs:

CAD model, material specifications, tooling data, spindle speeds and feed rate data calculations

Outputs:

CAM files, program code and coordinates, manufacturing sequences, tooling requirements, auxiliary data

Programming methods: CAD/CAM, manual programming, conversational programming

Component set-up:

Zero datum setting, tool set-up and offsets, axis of movements

Work-holding:

Machine vice, chuck, fixtures, clamping, jigs

Tooling:

Milling cutters, lathe tools, drills, specialist tooling, tool holders, tool turrets and carousels

LO2 Produce 3D solid models of a component suitable for transfer into a CAM system

Solid modelling:

Extrude, cut, fillet, chamfer, holes, sweep, revolve, lines, arcs, insert planes, properties of solid models e.g. mass, centre of gravity, surface area

Geometry manipulation: Mirror, rotate, copy, array, offset

Component drawing: Set-up template, orthographic and multi-view drawings, sections, scale, dimensions, drawing Attributes e.g. material, reference points, tolerances, finish

LO3 Use CAM software to generate manufacturing simulations of a component

Import solid model:

Set-up, model feature and geometry identification, stock size, material

Manufacturing simulation:

Operations e.g. roughing and finishing, pockets, slots, profiling, holes, tool and work change positions, tool sizes and IDs, speeds and feeds, cutter path simulations, program editing

LO4 Design and produce a dimensionally accurate component on a CNC machine using a CAD/CAM system

CNC machine types:

Machining centres, turning centres, MCUs e.g. Fanuc, Siemens, and Heidenhain

Data transfer:

Structured data between CAD and CAM software e.g. datum position and model orientation; file types e.g. SLDPRT, parasolid, STL, IGES, DXF; transfer to CNC machine e.g. network, USB, Ethernet

Inspection:

Manual inspection e.g. using Vernier gauges, bore micrometres Automated inspection e.g. co-ordinate measuring machine (CMM), stages of inspection throughout manufacturing process

Pass	Merit	Distinction
LO1 Describe the key principl	es of manufacturing using a	D1 Critically evaluate,
P1 Describe the hardware and software elements of a typical CAD/CAM system P2 Describe, with examples, the inputs and outputs of the CAD/CAM process P3 Explain the different methods of component setup, work-holding and tooling available on CNC machines	M1 Analyse the suitability of different programming methods of CNC machines	examples, the impact of different machining conditions and specifications on component manufacturing
LO2 Produce 3D solid models	of a component suitable for	D2 Critically evaluate
P4 Design and produce a CAD solid model of a component to be manufactured on a CNC machine P5 Design a working drawing of a component containing specific manufacturing dotail	M2 Assess the importance of using different geometry manipulation methods for efficient model production	using a CAD/CAM system and solid modelling to manufacture components
LO3 Use CAM software to gen	erate manufacturing	D3 Analyse the effect
simulations of a component P6 Use CAM software to generate a geometrically accurate CAD solid model of a component	M3 Using CAM software, generate cutter tool path simulations	of applying different manufacturing techniques and modifications to achieve an optimised production time
LO4 Design and produce a din	nensionally accurate	D4 Critically analyse
 P7 Detail a part program for a component using CAM software and transfer the part program to a CNC machine and manufacture a component P8 Describe the structural elements of a CNC Machining Centre P9 Review a component manufactured on a CNC machine to verify its accuracy 	M4 Analyse different methods of component inspection used in manufacturing	giving illustrative examples, the different methods of data transfer through a CAD/CAM system

Textbooks

KUNWOO, L. (2000) Principles of CAD/CAM/CAE. Pearson.

McMAHAN, C. and BROWNE, J. (1999) CADCAM: Principles, Practice and Manufacturing Management. Prentice Hall.

Links

This unit links to the following related units: *Unit 1: Engineering Design* **Unit code:** F/615/1501

Level: 4

Credit value: 15

Introduction

There is a growing trend, in part due to the popularity of three-dimensional (3D) Computer Aided Design (CAD) systems, for students to generate two-dimensional (2D) drawings from three-dimensional (3D) solid models. 3D models do look impressive and whilst they clearly serve an important function in CAD design, in reality the vast majority of CAD drawings used in the industry are 2D based and, of those, a significant number are schematic drawings utilised by maintenance engineers, which cannot be produced using a 3D system.

The aim of this unit is to enable students to produce 2D CAD drawings (using industry standard CAD software), and to modify and construct electrical and mechanical drawings e.g. distribution systems, fire alarms, steam ranges, electrical and hydraulic circuits. This unit will support the development of the students' CAD abilities and build upon those skills to introduce the more advanced techniques that are used to create and modify schematic drawings quickly and efficiently. These techniques can be used to construct pre-prepared symbols for use in circuit diagrams, or be used to create unique symbols and symbol libraries.

Alongside the creation of schematic drawings utilising the block, attributes and insert commands, the students will also learn how to extract information to populate spreadsheets and databases, tabulating the information directly from the working drawing.

Learning outcomes

- 1. Create and modify CAD drawings.
- 2. Construct, insert and export blocks with textual attributes.
- 3. Produce complex schematic drawings.
- 4. Transfer information to external sources.

Essential content

LO1 Create and modify CAD drawings

Introduction to the user interface: Command line, Status Bar, panel titles and tabs Recognise and apply absolute, relative and polar coordinates

Drafting aids: Grid, snap, object snap, ortho and polar tracking

Draw commands: Linetypes, circle, text, hatching, dimensioning

Modifying commands: Copy, rotate, move, erase, scale, chamfer, fillet Creating and defining text and dimension styles

Creating layers: Layers/levels, colour

Viewing commands: Zoom, pan, viewports and layouts

LO2 Construct, insert and export blocks with textual attributes

Creating and editing blocks and write blocks Defining, editing and managing attributes Inserting blocks from external sources Attribute extraction Dynamic and nested blocks Using the design centre and tool palettes

LO3 Produce complex schematic drawings

Create block library and table legend, including symbols and description Create electrical, electronic, hydraulic and pneumatic schematic drawings

LO4 Transfer information to external sources

Electronic transfer of information: Data extraction and data extraction (DXE) files Extracting data to tables and spreadsheets Organise and refine the extracted data Table styles and formatting data extraction tables

Pass	Merit	Distinction
LO1 Create and modify CAD drawings		D1 Evaluate the
P1 Identify the range of	M1 Contrast the advantages	advantages of using
drawing aids that assist	and disadvantages of using	template files
productivity	CAD over manual drafting	
P2 Produce a template file to		
include a range of layers,		
dimension styles, text		
styles, border and title box		
LO2 Construct, insert and exp	port blocks with textual	D2
attributes		
P3 Create ten schematic	M2 Identify the advantages of	LO2 & LO3 Validate how
symbols	using blocks in a drawing	using attributes can
P4 Add appropriate attribute		Improve productivity
data to each of the		
schematic symbols and		
convert into blocks		
LO3 Produce complex schema	tic drawings	
P5 Produce a block library	M3 Describe the advantages	
and table legend and	of using block libraries and	
integrate into a template file	how they can enhance	
P6 Create a complex	templates	
schematic drawing using		
electrical/electronic or		
hydraulic symbols		
LU4 Transfer information to external sources		D2 Assass how electropic
P7 Extract attribute data to	M4 Appraise the process	transfor of information
Excel spreadsneets	for extracting drawing data to	
of using data avtraction	create a table	provide example
		applications
(DAE) THES		applications

Textbooks

OMURA, G. and BENTON, B.C. (2014) *Mastering AutoCAD 2015 and AutoCAD LT 2015 Essentials*. Autodesk Official Press.

ONSTOTT, S. (2014) AutoCAD 2015 and AutoCAD LT 2015 Essentials. Autodesk Official Press.

Websites

https://knowledge.autodesk.com Autodesk Knowledge Network (Tutorials)

Links

This unit links to the following related units:

Unit 1: Engineering Design

Unit: 23 Computer Aided Design and Manufacture (CAD/CAM)

LEVEL 5 CORE/MANDATORY UNITS

Unit 34: Research Project

Unit code: J/615/1502

Level: 5

Credit value: 30

Introduction

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

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

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

Learning outcomes

- 1. Conduct the preliminary stages involved in the creation of an engineering research project.
- 2. Examine the analytical techniques used to work on all stages of the project and strategies required to overcome the challenges involved in a research project.
- 3. Reflect on the impact the research experience could have in enhancing personal or group performance within an engineering context.
- 4. Explore the communication approach used for the preparation and presentation of the research project's outcomes.

LO1 Conduct the preliminary stages involved in the creation of an engineering research project

Setting up the research preliminaries: Project proposal Developing a research question(s) Selection of project approach Identification of project supervisor Estimation of resource requirements, including possible sources of funding Identification of project key objectives, goals and rationale Development of project specification

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

Investigative skills and project strategies: Selecting the method(s) of collecting data Data analysis and interpreting findings Literature review Engaging with technical literature Technical depth Multi-perspectives analysis Independent thinking Statement of resources required for project completion Potential risk issues, including health and safety, environmental and commercial Project management and key milestones

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

Research purpose: Detailed statement of project aims Relevance of the research Benefits and beneficiaries of the research

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

Reporting the research: Project written presentation Preparation of a final project report Writing research report Project oral presentation such as using short presentation to discuss the work and conclusions

Pass	Merit	Distinction
LO1 Conduct the preliminary stages involved in the		D1 Produce a
creation of an engineering res	earch project	comprehensive project
P1 Produce a research	M1 Analyse the project	proposal that evaluates
project proposal that clearly	specification and identify any	and justifies the rationale
defines a research question	project risks	for the research
or hypothesis		
P2 Discuss the key project		
objectives, the resulting		
goals and rationale		
LO2 Examine the analytical te	echniques used to work on	D2 Critically analyse
all stages of the project and s	trategies required to	literature sources
overcome the challenges invo	lved in a research project	utilised, data analysis
P3 Conduct a literature	M2 Analyse the strategies	conducted and strategies
review of published	used to overcome the	to deal with challenges
material, either in hard	challenges involved in the	
copy or electronically, that	literature review stage	
Is relevant to your research	W3 Discuss merits, limitations	
project	and pittails of approaches to	
F4 Examine appropriate	data collection and analysis	
approaches to primary and		
secondary research		
103 Reflect on the impact the	research experience could	D3 Critically evaluate
have in enhancing personal or group performance within an		how the research
engineering context	group performance within an	experience enhances
P5 Reflect on the	M4 Evaluate the benefits	personal or group
effectiveness and the impact	from the findings of the	performance within an
the experience has had	research conducted	engineering context
upon enhancing personal or		5 5
group performance		
LO4 Explore the communications approach used for the		D4 Critically reflect how
preparation and presentation of the research project's		the audience for whom
outcomes		the research was
P6 Explore the different	M5 Evaluate how the	conducted influenced the
types of communications	communication approach	Communication approach
approaches that can be	meets research project	used for the preparation
used to present the	outcomes and objectives	and presentation of the
research outcomes		research project's
P7 Communicate research		outcomes
outcomes in an appropriate		
manner for the intended		
audience		

Textbooks

LEONG, E.C., LEE-HSIA, C.H. and WEE ONG, K.K. (2015) *Guide to Research Projects for Engineering Students: Planning, Writing and Presenting*. Apple Academic Press Inc.

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

Websites

https://www.apm.org.uk/

Association for Project Management (General Reference)

Unit 35: Professional Engineering Management

Unit code: L/615/1503

Level: 5

Credit value: 15

Introduction

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

The aim of this unit is to continue building up on the knowledge gained in *Unit 4: Managing a Professional Engineering Project*, to provide students with the professional standards for engineers and to guide them on how to develop the range of employability skills needed by professional engineers.

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

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

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

Learning outcomes

- 1. Evaluate the risk evaluation theories and practices associated with the management of projects for the production of current and developing technology.
- 2. Produce an engineering services delivery plan that meets the requirements of a sector-specific organisation.
- 3. Develop effective leadership, individual and group communication skills.
- 4. Develop personal commitment to professional standards and obligations to society, the engineering profession and the environment.

LO1 Evaluate the risk evaluation theories and practices associated with the management of projects for the production of current and developing technology

The engineering business environment: Organisational structures and functional elements Strategic planning and deployment Engineering strategy and services delivery planning The role of sustainability Total Quality Management (TQM) Logistics and supply chain management New product development strategies Legal obligations and corporate responsibility

Engineering relationships: The relationship between engineering and financial management, marketing, purchasing, quality assurance and public relations

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

Engineering management tools: Problem analysis and decision-making, risk management, change management, performance management, product and process improvement, project management and earned value analysis

LO3 Develop effective leadership, individual and group communication skills

Managing people: Describe the most effective leadership styles Techniques to effectively manage teams

Steps to follow for delivering effective presentations. Meeting management skills Communication and listening skills Negotiating skills Human error evaluation Coaching and mentoring

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

Becoming a professional engineer: Engineering social responsibility Importance of being active and up to date with the engineering profession, new developments and discoveries Methods of Continuing Professional Development (CPD)

Pass	Merit	Distinction
LO1 Evaluate the risk evaluat	ion theories and practices	D1 Specify and analyse
associated with the management of projects for the		the challenges
production of current and dev	eloping technology	encountered when
P1 Evaluate the risk	M1 Critically evaluate the	meeting the
evaluation theories and	main elements and issues	requirements for
practices associated with	that impact the successful	successfully managing
the management of	management of engineering	engineering activities,
P2 Access elements and	activities	
FZ Assess elements and		overcome these
successful management of		challenges
engineering activities		- Chancinges
LO2 Produce an engineering	services delivery plan that	D2 Critically evaluate
meets the requirements of a s	sector-specific organisation	contingencies that might
P3 Develop an engineering	M2 Evaluate how each step	prevent the delivery plan
services delivery plan,	of the delivery plan developed	meeting the
applying the appropriate	meets the requirements of a	requirements of a sector-
sector-specific requirements	sector-specific organisation	specific organisation
P4 Determine the		
engineering management		
tools needed for designing		
an engineering services		
delivery plan	hin individual and group	
communication skills	nip, individual and group	D3 Critically evaluate
P6 Describe the steps for	M3 Evaluate leadership	effective ways for the
effective persuasion and	styles and effective	coaching and mentoring
negotiation	communication skills using	of disillusioned
P7 Explain the steps for	specific examples in an	colleagues or of a poorly
managing effective group	organisational context	performing team
meetings		
P8 Outline the steps to		
deliver an effective		
presentation		
LO4 Develop personal commit	ment to professional standards	D4 Evaluate and provide
the environment		Justifications on why it is
P9 Discuss the context of	M4 Summarise the	and up to date with the
social responsibility for	engineering profession	Engineering profession's
scientists and engineers	ethical standards and	new developments and
P10 Explore the ways in	patterns of behaviour	discoveries
which an engineer can		
engage in continuing		
professional development		

Recommended Resources

Textbooks

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

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

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

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

Websites

http://www.engc.org.uk/	Engineering Council UK-SPEC UK Standard for Professional Engineering Competence (E-Books)
http://www.ewb-uk.org/	Engineering without Borders (General Reference)

Links

This unit links to the following related units:

Unit 4: Managing a Professional Engineering Project

Unit code: J/615/1516

Level: 5

Credit value: 15

Introduction

Manufacturing systems engineering is concerned with the design and on-going operation and enhancement of the integrated elements within a manufacturing system, which is a very complex activity, even for simple products. The art of manufacturing systems engineering is essentially designing systems that can cope with that complexity effectively.

The aim of this unit is to develop students' understanding of that complexity within a modern manufacturing environment. Among the topics covered in this unit are: elements that make up a manufacturing system, including production engineering, plant and maintenance engineering, product design, logistics, production planning and control, forecast quality assurance, accounting and purchasing, all of which work together within the manufacturing system to create products that meet customers' requirements.

On successful completion of this unit students will be able to explain the principles of a manufacturing system and consider how to design improvements. They will be introduced to all the elements that make up a modern manufacturing system, and they will learn how to optimise the operation of existing systems through discerning use of monitoring data. Some of the elements will be developed in greater depth; of particular importance will be looking at the systems of production planning and control, which are the day-to-day tools used to manage the manufacturing system effectively.

Learning outcomes

- 1. Illustrate the principles of manufacturing systems engineering and explain their relevance to the design and enhancement of manufacturing systems.
- 2. Use a range of analysis tools, including value stream mapping, to determine the effectiveness and efficiency of a manufacturing system, and then develop an appropriate future state for that system.
- 3. Outline the impact of different production planning approaches on the effectiveness of a manufacturing system.
- 4. Define the responsibilities of manufacturing systems engineering and review how they enable successful organisations to remain competitive.

LO1 Illustrate the principles of manufacturing systems engineering and their relevance to the design and enhancement of manufacturing systems

Manufacturing systems elements:

Elements to be considered include quality, cost, delivery performance and optimising output

Problem-solving and managing complexity, maintenance scheduling and planning, resource planning and productivity

Effect of testing and data analysis on performance

LO2 Use a range of analysis tools, including value stream mapping, to determine the effectiveness and efficiency of a manufacturing system, and then develop an appropriate future state for that system

Analysis tools:

Introduction to value stream mapping, and the value of both current state mapping and future state mapping

Bottle-neck analysis, by using process improvement tools and techniques e.g. value stream analysis, simulation, Kanban

Using key performance indicators to understand the performance of a manufacturing system e.g. overall equipment effectiveness, lead-time, cycle time, waiting time, yield, delivery performance, safety metrics

Reviewing key performance indicators; methods for presenting metrics and performance e.g. balanced scorecards, performance dashboards, Andon boards, Gemba walks

LO3 Outline the impact of different production planning approaches on the effectiveness of a manufacturing system

Production planning approaches:

Examples of production planning strategy: push vs pull factors, Kanban systems, make to stock, make to order and engineer to order

Production planning approaches such as batch and queue, pull/kanban, just-intime, modular design, configuration at the final point, and master scheduling

Production planning management tools:

Enterprise Resource Mapping (ERP) systems, Material Resource Planning (MRP 2) and Manufacturing Execution systems, ability to managing complexity and resourcing through information technology

Industrial engineering issues: the importance of standard times and the impact on productivity and the costing of products. Standard work underpins the repeatability of process and quality control

LO4 Review the functions of manufacturing systems engineering and how they enable successful organisations to remain competitive

Effectiveness of manufacturing systems:

Plant layout design, planning and control, productivity and continuous improvement, quality control and equipment effectiveness

Return on investment and capital expenditure, control of the cost of planned maintenance

Manufacturing information technology: the supply of data from the process to decision-makers e.g. failure modes for both product and system, maintenance and down time data, standard times for production, material control, energy usage
Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
LO1 Illustrate the principles of manufacturing systems		D1 Apply value stream mapping to a production process to evaluate the
engineering and their relevance to the design and		
enhancement of manufacturing systems		
P1 Illustrate the principles	M1 Evaluate the impact	efficiency of that process
of manufacturing	that manufacturing systems	by using the current state
engineering	have on the success of a	map to suggest
P2 Explain the relevance of	manufacturing organisation	improvements
manufacturing systems		
engineering to the design		
of a manufacturing system		
LO2 Use a range of analysis tools, including value stream		D2 Review value stream mapping against other production planning methodologies and justify
mapping, to determine the effectiveness and efficiency of		
a manufacturing system, and then develop an		
appropriate future state for that system		
P3 Apply value stream	M2 Identify optimisation	its use as a production
mapping to visualise a	opportunities through value	planning tool
production process	stream mapping of a	
	production process	
LO3 Outline the impact of different production planning		D3 Justify the most appropriate production
approaches on the effectiveness of a manufacturing		
system		planning technique and
P4 Identify the common	M3 Evaluate the	its suitability for a
production planning	effectiveness of production	particular manufacturing
approaches and state their	planning methods	approach, such as make
impact on manufacturing	M4 Explore the	to stock, make to order,
systems	effectiveness of common	or engineer to order
P5 Define the types of	production planning	
manufacturing approach,	techniques to identify which	
such as make to stock,	production approach they	
make to order and	complement	
engineer to order		
LO4 Review the functions of manufacturing systems		D4 Critically consider the elements of an existing manufacturing system to
engineering and how they enable successful organisations		
to remain competitive		
P6 Define the core	M5 Evaluate the impact	appraise why this is
responsibilities of a	that a manufacturing	successful
manufacturing systems	systems engineering has on	
engineer	successful manufacturing	
P7 Identify the key	organisations	
contributing success factors		
of a manufacturing system		

Recommended Resources

Textbooks

BICHENO, J. and HOLWEG, M. (2009) The Lean Toolbox. 4th Ed. PICSIE Books.

CHOPRA, S. and MEINDL, P. (2015) *Supply Chain Management: Strategy, Planning, and Operation (Global Edition).* 6th Ed. Pearson.

SLACK, N. (2013) Operations Management. 7th Ed. Pearson.

WOMACK, J., JONES, D. and ROOS, D. (1990) *The Machine That Changed the World*. Free Press.

Websites

http://www.industryweek.com/

Industry Week Five Benefits of an MES (Article)

Links

This unit links to the following related units: Unit 49: Lean Manufacturing Unit 50: Advanced Manufacturing Technology Unit 51: Sustainability

Unit 49: Lean Manufacturing

Unit code: L/615/1517

Level: 5

Credit value: 15

Introduction