

Content mapping of:

(A) Pearson BTEC Level 3 Nationals in Engineering (RQF - 2016) suite units to (B) Pearson BTEC Level 3 in Advanced Manufacturing Engineering (Development Technical Knowledge) suite units

Introduction:

Some learners complete a Pearson BTEC Level 3 Nationals in Engineering (RQF - 2016) qualification (perhaps at college between the ages of 16 and 18) and then move onto an engineering apprenticeship, where the standard requires the completion of a Pearson BTEC Level 3 in Advanced Manufacturing Engineering (Development Technical Knowledge) qualification.

This intention of this document is to indicate whether a learner would generally have some appropriate underpinning knowledge/understanding that would enable them to complete the assessments for units in (B) if they have already completed the learning/assessments for similar units in (A).

Suite (A) is on the left hand side of this document and has 58 units, including some that are externally assessed. All of the Learning Aims are listed for each of the internally-assessed units, and the Topics are listed for the externally-assessed units. Suite (B) is on the right hand side of this document.

This document provides content mapping at Learning Aim [for (A)] / Learning Outcome [for (B)] level per unit; however, as the content does not map directly from units in (A) to units in (B) it is just an indication of partial content mapping. Not all

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aspects of a Learning Aim [for (A)] will cover all aspects of a similar Learning Outcome [for (B)], and therefore Tutors will also need to use their subject knowledge, professional judgement and any other information they have about the learner(s) concerned to make a decision about whether they are ready to complete the assessments for units from (B).

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Please note (1):

This is generally not a document for full Recognition of Prior Learning (RPL) mapping.

- The only units where full RPL mapping from (A) to (B) is available [meaning that if learners have completed and have at least a 'Pass' grade for a unit in (A) they do not have to complete the assessments in the corresponding unit for (B)] are highlighted in yellow at the top of the document.
- As an example, if a learner has at least a 'Pass' grade for Unit 7 in (A) they do not have to complete the assessments for Unit 5 in (B); in addition, they do not need to complete the assessment for Unit 3, Learning Outcome 4 in (B).
- RPL mapped units in (B) must be claimed at the same grade as that received for the unit in (A).

Please note (2):

- Units 1, 3 and 6 in (A) are externally assessed through an examination and awarded; the external examination process may mean that learners gain a 'Pass' grade without being able to demonstrate, under examination conditions, 'appropriate' underpinning knowledge/understanding of all the Topics.
- In addition, Unit 3 in (A) is 'synoptic'; normally, a synoptic unit is one that a learner would take later in a programme, where they will be expected to apply learning from a range of units. As a result, Unit 3 in (A) can be partially mapped to a large range of units/Learning Outcomes in (B).

Please note (3):

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- The units from suite (A) that are highlighted in yellow at the top of the document have a full set of Authorised Assignment Briefs (AABs) - see [here](#) - and these AABs can be used to summatively assess the corresponding unit in suite (B); for example, the AABs for Unit 8 in suite (A) can be used to summatively assess Unit 6 in suite (B).

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(A) Pearson BTEC Level 3 Nationals in Engineering (RQF) suite units	(B) Pearson BTEC Level 3 in Advanced Manufacturing Engineering (Development Technical Knowledge) suite units
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Unit 7 - Calculus to Solve Engineering Problems	
A Examine how differential calculus can be used to solve engineering problems	Unit 3: Mathematics for Engineering Technicians 4 Be able to use elementary calculus techniques Unit 5: Calculus to Solve Engineering Problems 1 Examine how differential calculus can be used to solve engineering problems
B Examine how integral calculus can be used to solve engineering problems	Unit 3: Mathematics for Engineering Technicians 4 Be able to use elementary calculus techniques Unit 5: Calculus to Solve Engineering Problems 2 Examine how integral calculus can be used to solve engineering problems
C Investigate the application of calculus to solve a defined specialist engineering problem	Unit 5: Calculus to Solve Engineering Problems 3 Investigate the application of calculus to solve a defined specialist engineering problem

Unit 8 - Further Engineering Mathematics	
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A Examine how sequences and series can be used to solve engineering problems	Unit 6: Further Engineering Mathematics 1 Examine how sequences and series can be used to solve engineering problems
B Examine how matrices and determinants can be used to solve engineering problems	Unit 6: Further Engineering Mathematics 2 Examine how matrices and determinants can be used to solve engineering problems
C Examine how complex numbers can be used to solve engineering problems	Unit 6: Further Engineering Mathematics 3 Examine how complex numbers can be used to solve engineering problems
D Investigate how statistical and probability techniques can be used to solve engineering problems	Unit 6: Further Engineering Mathematics 4 Investigate how statistical and probability techniques can be used to solve engineering problems

Unit 33 - Computer Systems Security	
A Investigate the threats to computer systems in engineering organisations and the organisations' legal responsibilities	Unit 111: Cyber Security in Engineering 1 Understand the threats to computer systems in engineering organisations and the organisations' legal responsibilities
B Investigate computer system vulnerabilities and protection measures used in engineering organisations	Unit 111: Cyber Security in Engineering 2 Know computer system vulnerabilities and protection measures used in engineering organisations

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C Plan security measures to protect an engineering computer system from threats	Unit 111: Cyber Security in Engineering 3 Be able to plan security measures to protect an engineering computer system from threats
D Implement security measures to protect an engineering computer system from threats	Unit 111: Cyber Security in Engineering 4 Be able to implement security measures to protect an engineering computer system from threats

Unit 45 - Additive Manufacturing Processes	
A Examine the technology and characteristics of additive manufacturing processes as used in industry	Unit 112: Additive Manufacturing Processes 1 Examine the technology and characteristics of additive manufacturing processes as used in industry
B Investigate component design considerations and finishing processes required to effectively use additive manufacturing processes	Unit 112: Additive Manufacturing Processes 2 Investigate component design considerations and finishing processes required to effectively use additive manufacturing processes
C Develop a component using additive manufacturing processes safely	Unit 112: Additive Manufacturing Processes 3 Develop a component using additive manufacturing processes safely

Unit 48 - Aircraft Flight Principles and Practice	
A Examine the atmospheric, mechanical and fluid principles	Unit 58: Aircraft Flight Principles and Practice

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affecting flight	A Examine the atmospheric, mechanical and fluid principles affecting flight
B Explore safely the lift and drag force generation and interaction that create aircraft flight	Unit 58: Aircraft Flight Principles and Practice B Explore safely the lift and drag force generation and interaction that create aircraft flight
C Investigate the nature and methods used to stabilise and control aircraft	Unit 58: Aircraft Flight Principles and Practice C Investigate the nature and methods used to stabilise and control aircraft

Unit 49 - Aircraft Workshop Methods and Practice	
A Explore safe working practices and suitable component selection in an aircraft workshop environment	Unit 99: Aircraft Workshop Methods and Practice 1 Explore safe working practices and suitable component selection in an aircraft workshop environment
B Carry out processes to inspect and fit aircraft mechanical hardware safely that will help to ensure airworthiness	Unit 99: Aircraft Workshop Methods and Practice 2 Carry out processes to inspect and fit aircraft mechanical hardware safely that will help to ensure airworthiness
C Carry out processes to inspect and fit aircraft electrical hardware safely that will help to ensure airworthiness	Unit 99: Aircraft Workshop Methods and Practice 3 Carry out processes to inspect and fit aircraft electrical hardware safely that will help to ensure airworthiness
D Review mechanical and electrical workshop inspection and fitting processes and reflect on personal performance	Unit 99: Aircraft Workshop Methods and Practice 4 Review mechanical and electrical workshop inspection and

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	fitting processes and reflect on personal performance
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Unit 50 - Aircraft Gas Turbine Engines	
A Examine the scientific principles and operation of aircraft gas turbine engines that produce thrust	Unit 95: Aircraft Gas Turbine Engines 1 Examine the scientific principles and operation of aircraft gas turbine engines that produce thrust
B Examine the function and operation of gas turbine engine components and systems that produce thrust	Unit 95: Aircraft Gas Turbine Engines 2 Examine the function and operation of gas turbine engine components and systems that produce thrust
C Investigate the factors affecting the performance and environmental impact of aircraft using gas turbine propulsion	Unit 95: Aircraft Gas Turbine Engines 3 Investigate the factors affecting the performance and environmental impact of aircraft using gas turbine propulsion

Unit 51 - Aircraft Propulsion Systems	
A Examine the function and operation of aircraft fuel and engine control systems that support safe aircraft power plant operation	Unit 100: Aircraft Propulsion Systems 1 Examine the function and operation of aircraft fuel and engine control systems that support safe aircraft power plant operation
B Examine the function and operation of aircraft engine lubrication and air systems that support safe aircraft power	Unit 100: Aircraft Propulsion Systems 2 Examine the function and operation of aircraft engine

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plant operation	lubrication and air systems that support safe aircraft power plant operation
C Examine the function and operation of aircraft fire and ice protection systems that support safe aircraft power plant operation	Unit 100: Aircraft Propulsion Systems 3 Examine the function and operation of aircraft fire and ice protection systems that support safe aircraft power plant operation

Unit 52 - Airframe Construction and Repair	
A Examine the construction and protection methods used to ensure airworthiness of airframe structures	Unit 59: Airframe Construction and Repair A Examine the construction and protection methods used to ensure airworthiness of airframe structures
B Examine how inspection and repair methods are used in the maintenance of composite airframes and components	Unit 59: Airframe Construction and Repair B Examine how inspection and repair methods are used in the maintenance of composite airframes and components
C Carry out processes to inspect and repair safely an airframe composite structure or components that will help to ensure airworthiness	Unit 59: Airframe Construction and Repair C Carry out processes to inspect and repair safely an airframe composite structure or components that will help to ensure airworthiness

Unit 53 - Airframe Mechanical Systems	
A Investigate how the operation of hydraulic-power, landing-	Unit 60: Airframe Mechanical Systems

gear and flying-control systems contribute to safe flight	A Investigate how the operation of hydraulic-power, landing-gear and flying-control systems contribute to safe flight
B Examine how the operation of cabin environmental control and protection systems contribute to the protection of passengers and crew	Unit 60: Airframe Mechanical Systems B Examine how the operation of cabin environmental control and protection systems contribute to the protection of passengers and crew
C Examine how the operation of airframe fuel, ice- and fire-protection systems contribute to safe flight	Unit 60: Airframe Mechanical Systems C Examine how the operation of airframe fuel, ice- and fire-protection systems contribute to safe flight

Unit 54 - Aircraft Electrical and Instrument Systems	
A Examine how electrical power generation and distribution systems support the safe operation of aircraft	Unit 61: Aircraft Electrical and Instrument Systems A Examine how electrical power generation and distribution systems support the safe operation of aircraft
B Examine how electrical actuation, loading, control and warning systems contribute to maintaining safe flight	Unit 61: Aircraft Electrical and Instrument Systems B Examine how electrical actuation, loading, control and warning systems contribute to maintaining safe flight
C Explore how air data and gyroscopic instruments and systems contribute to maintaining safe flight	Unit 61: Aircraft Electrical and Instrument Systems C Explore how air data and gyroscopic instruments and systems contribute to maintaining safe flight

Unit 55 - Aircraft First Line Maintenance Operations	
A Examine aircraft safe maintenance operations in a first-line engineering environment	Unit 101: Aircraft First Line Maintenance Operations 1 Examine aircraft safe maintenance operations in a first-line engineering environment
B Examine the planning, quality processes and administrative procedures associated with aircraft first-line maintenance operations	Unit 101: Aircraft First Line Maintenance Operations 2 Examine the planning, quality processes and administrative procedures associated with aircraft first-line maintenance operations
C Carry out aircraft first-line maintenance operations that safely restore aircraft to a serviceable condition	Unit 101: Aircraft First Line Maintenance Operations 3 Carry out aircraft first-line maintenance operations that safely restore aircraft to a serviceable condition
D Review aircraft first-line maintenance operations and reflect on personal performance	Unit 101: Aircraft First Line Maintenance Operations 4 Review aircraft first-line maintenance operations and reflect on personal performance

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Unit 1 - Engineering Principles (Externally assessed)	
A Algebraic and trigonometric mathematical methods	Unit 3: Mathematics for Engineering Technicians 1 Be able to use algebraic methods 2 Be able to use trigonometric methods and standard formulae to determine areas and volumes
B Static engineering systems	Unit 8: Mechanical Principles of Engineering Systems 1 Be able to determine the effects of loading in static engineering systems
C Dynamic engineering systems	Unit 8: Mechanical Principles of Engineering Systems 2 Be able to determine work, power and energy transfer in dynamic engineering systems Unit 55: Further Mechanical Principles and Applications 4 Be able to determine the operating characteristics of simple lifting machines
D Fluid engineering systems	Unit 8: Mechanical Principles of Engineering Systems 3 Be able to determine the parameters of fluid systems

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E Static and direct current electricity and circuits	<p>Unit 33: Further Electrical Principles</p> <p>2 Understand the transient behaviour of resistor-capacitor (RC) and resistor-inductor (RL) DC circuits</p> <p>3 Be able to apply single-phase alternating current (AC) theory</p> <p>Unit 56: Electrical and Electronic Principles in Engineering</p> <p>1 Be able to use circuit theory to determine voltage, current and resistance in direct current (DC) circuits</p> <p>2 Be able to apply the concepts of capacitance in DC circuits</p>
F Magnetism and electromagnetic induction	<p>Unit 56: Electrical and Electronic Principles in Engineering</p> <p>3 Know the principles and properties of magnetism</p>
G Single-phase alternating current	<p>Unit 56: Electrical and Electronic Principles in Engineering</p> <p>4 Be able to use single-phase alternating current (AC) theory</p>

Unit 2 - Delivery of Engineering Processes Safely as a Team	
A Examine common engineering processes to create products or deliver services safely and effectively as a team	<p>Unit 1: Health and Safety in the Engineering Workplace</p> <p>1 Understand health and safety legislation and regulations</p> <p>Unit 15: Engineering Primary Forming Processes</p> <p>1 Understand how moulding techniques involving metals, ceramics and polymers are used</p> <p>2 Understand how deformation processes involving metals</p>

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	<p>and polymers are used</p> <p>Unit 16: Engineering Secondary and Finishing Techniques</p> <p>1 Understand how a range of secondary machining techniques are used</p> <p>Unit 29: Electrical Installation</p> <p>4 Know the statutory and non-statutory regulations relating to the provision of an electrical installation</p> <p>Unit 96: Human Factors and Performance in Aviation</p> <p>1 Understand why human factors are important in aviation</p> <p>4 Understand personal factors that affect human performance</p> <p>5 Understand how physical aspects of the working environment affect human performance</p> <p>6 Understand how categories of tasks can affect human performance</p>
<p>B Develop two-dimensional computer-aided drawings that can be used in engineering processes</p>	<p>Unit 12: Engineering Drawing for Technicians</p> <p>3 Be able to produce engineering drawings</p> <p>4 Be able to produce engineering drawings using a computer-aided design (CAD) system</p> <p>Unit 13: Computer-aided Drafting in Engineering</p> <p>4 Be able to produce and interpret CAD drawings</p>
<p>C Carry out engineering processes safely to manufacture a</p>	<p>Unit 1: Health and Safety in the Engineering Workplace</p>

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<p>product or to deliver a service effectively as a team</p>	<p>2 Know about hazards and risks in the workplace</p> <p>Unit 2: Communications for Engineering Technicians</p> <p>1 Be able to interpret and use engineering sketches/circuit/network diagrams to communicate technical information</p> <p>3 Be able to obtain and use engineering information</p> <p>Unit 96: Human Factors and Performance in Aviation</p> <p>3 Understand aspects of social psychology</p> <p>7 Understand communication in the workplace</p> <p>9 Understand risk assessments in aeronautical engineering environments</p>
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<p>Unit 3 - Engineering Product Design and Manufacture (Externally assessed and synoptic)</p>	
<p>A Design triggers, challenges, constraints and opportunities, and materials and processes</p>	<p>Unit 7: Properties and Applications of Engineering Materials</p> <p>2 Understand material properties and the effects of processing on the structure and behaviour of engineering materials</p> <p>4 Understand about the modes of failure of engineering materials</p> <p>Unit 9: Applications of Mechanical Systems in</p>

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	<p>Engineering</p> <p>1 Understand the purposes and uses of lubricants and lubrication systems</p> <p>3 Understand the operation and uses of mechanical power transmission systems</p> <p>Unit 15: Engineering Primary Forming Processes</p> <p>1 Understand how moulding techniques involving metals, ceramics and polymers are used</p> <p>2 Understand how deformation processes involving metals and polymers are used</p> <p>3 Understand how shaping and assembly processes involving composites are used</p> <p>Unit 16: Engineering Secondary and Finishing Techniques</p> <p>1 Understand how a range of secondary machining techniques are used</p> <p>4 Know how finishing techniques are used</p> <p>Unit 17: Fabrication Processes and Technology</p> <p>3 Know how materials are formed and assembled to produce fabricated structures</p> <p>Unit 34: Manufacturing Planning</p> <p>1 Understand the techniques and policies used to improve product manufacturing efficiency</p>
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	<p>Unit 65: Engineering Design 1 Know how the design process operates when dealing with customers</p> <p>Unit 114: Environmental Engineering and Sustainability 2 Understand design, system and product-based approaches to reducing environmental impact</p>
B Interpreting a brief into operational requirements and analysing existing products	<p>Unit 65: Engineering Design 1 Know how the design process operates when dealing with customers 2 Know the impact of legislation, standards and environmental and manufacturing constraints can have on the design function</p> <p>Unit 67: Commercial Aspects of Engineering Organisations 2 Know about competitive commercial activities 3 Know about local and national constraints</p>
C Using an iterative process to design ideas and develop a modified product proposal	<p>Unit 2: Communications for Engineering Technicians 1 Be able to interpret and use engineering sketches/circuit/network diagrams to communicate technical information 2 Be able to use verbal and written communication skills in engineering settings</p>

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	<p>3 Be able to obtain and use engineering information</p> <p>Unit 12: Engineering Drawing for Technicians</p> <p>1 Be able to sketch engineering components</p> <p>2 Be able to interpret engineering drawings that comply with drawing standards</p> <p>Unit 65: Engineering Design</p> <p>3 Be able to prepare design proposals that meet the requirements of a product design specification</p> <p>4 Be able to produce and present a final design solution</p> <p>Unit 114: Environmental Engineering and Sustainability</p> <p>4 Be able to carry out a redesign of an engineered product or system to reduce environmental impact</p>
D Technical justification and validation of the design solution	<p>Unit 3: Mathematics for Engineering Technicians</p> <p>3 Be able to use statistical methods to display data</p>

Unit 4 - Applied Commercial and Quality Principles in Engineering	
A Examine business functions and trade considerations that help engineering organisations thrive	<p>Unit 36: Business Operations in Engineering</p> <p>1 Understand how an engineering company operates</p> <p>Unit 67: Commercial Aspects of Engineering Organisations</p> <p>1 Know about the business planning and corporate</p>

	<p>expectations of an engineering organisation</p> <p>2 Know about competitive commercial activities</p>
B Explore activity-based costing as a method to control costs and to determine if an engineering product or service is profitable	<p>Unit 36: Business Operations in Engineering</p> <p>4 Be able to apply costing techniques to determine the cost effectiveness of an engineering activity</p>
C Explore how engineering organisations use quality systems and value management to create value	<p>Unit 67: Commercial Aspects of Engineering Organisations</p> <p>4 Know about the concepts of quality assurance and quality control</p> <p>Unit 69: Statistics and Business Improvement Techniques</p> <p>1 Be able to apply the principles and processes of value management</p>

Unit 5 - A Specialist Engineering Project	
A Investigate an engineering project in a relevant specialist area	<p>Unit 2: Communications for Engineering Technicians</p> <p>2 Be able to use verbal and written communication skills in engineering settings</p> <p>3 Be able to obtain and use engineering information</p> <p>Unit 4: Engineering Project</p> <p>1 Be able to keep records, specify a project, agree procedures and choose a solution</p> <p>2 Be able to plan and monitor a project</p>

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	<p>3 Be able to implement the project plan within agreed procedures</p>
<p>B Develop project-management processes and a design solution for the specialist engineering project as undertaken in industry</p>	<p>Unit 2: Communications for Engineering Technicians</p> <p>2 Be able to use verbal and written communication skills in engineering settings</p> <p>3 Be able to obtain and use engineering information</p> <p>Unit 4: Engineering Project</p> <p>1 Be able to keep records, specify a project, agree procedures and choose a solution</p> <p>2 Be able to plan and monitor a project</p> <p>3 Be able to implement the project plan within agreed procedures</p> <p>4 Be able to present the project outcome</p>
<p>C Undertake the solution for a specialist engineering project and present the solution as undertaken in industry</p>	<p>Unit 2: Communications for Engineering Technicians</p> <p>2 Be able to use verbal and written communication skills in engineering settings</p> <p>3 Be able to obtain and use engineering information</p> <p>Unit 4: Engineering Project</p> <p>1 Be able to keep records, specify a project, agree procedures and choose a solution</p> <p>2 Be able to plan and monitor a project</p> <p>4 Be able to present the project outcome</p>

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	Unit 114: Environmental Engineering and Sustainability 4 Be able to carry out a redesign of an engineered product or system to reduce environmental impact
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Unit 6 - Microcontroller Systems for Engineers (Externally assessed)	
A Investigate typical microcontroller system hardware	Unit 19: Selecting and Using Programmable Controllers 1 Understand the selection, hardware and software requirements of a programmable controller Unit 38: Industrial Process Controllers 3 Know about the types and operation of programmable logic controllers Unit 75: Microprocessor Systems and Applications 1 Know how microprocessor-based systems can be applied 2 Understand the architecture and operation of a microprocessor system 4 Be able to use a microprocessor development system to prepare and run a program Unit 76: Principles and Applications of Microcontrollers 2 Understand microcontroller communication interfaces and human interface devices 3 Understand microcontroller hardware control methods

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	4 Be able to select, implement and test a microcontroller
B Programming Techniques and Coding	<p>Unit 19: Selecting and Using Programmable Controllers 2 Be able to use programming techniques to produce a program for a modern programmable controller</p> <p>Unit 38: Industrial Process Controllers 4 Be able to write and fault-find programmable logic controller programs</p> <p>Unit 75: Microprocessor Systems and Applications 3 Understand decimal, binary and hexadecimal number systems, instructions and subroutines 4 Be able to use a microprocessor development system to prepare and run a program</p> <p>Unit 76: Principles and Applications of Microcontrollers 4 Be able to select, implement and test a microcontroller</p> <p>Unit 113: Autonomous Systems 3 Be able to develop an autonomous bot for an advanced manufacturing application</p>
C System development cycle	N/A

Unit 8 - Further Engineering Mathematics	
A Examine how sequences and series can be used to solve engineering problems	See RPL mapping (above)

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B Examine how matrices and determinants can be used to solve engineering problems	See RPL mapping (above)
C Examine how complex numbers can be used to solve engineering problems	See RPL mapping (above)
D Investigate how statistical and probability techniques can be used to solve engineering problems	Unit 109: Data Analytics/Big Data 2 Know about the statistical software tools and techniques used to analyse data in engineering organisations 3 Be able to carry out analysis of statistical data to meet the needs of an engineering organisation

Unit 9 - Work Experience in the Engineering Sector	
A Examine the benefits of work experience in engineering for own learning and development	N/A
B Develop a work experience plan to support own learning and development	N/A
C Carry out work experience tasks to meet set objectives	Unit 4: Engineering Project 1 Be able to keep records, specify a project, agree procedures and choose a solution
D Reflect on how work experience influences own personal and professional development	N/A

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Unit 10: Computer Aided Design in Engineering	
A Develop a three-dimensional computer-aided model of an engineered product that can be used as part of other engineering processes	Unit 13: Computer-aided Drafting in Engineering 4 Be able to produce and interpret CAD drawings 5 Be able to use CAD software to produce 3D drawings and views
B Develop two-dimensional detailed computer-aided drawings of an engineered product that can be used as part of other engineering processes	Unit 12: Engineering Drawing for Technicians 4 Be able to produce engineering drawings using a computer-aided design (CAD) system Unit 13: Computer-aided Drafting in Engineering 4 Be able to produce and interpret CAD drawings
C Develop a three-dimensional computer-aided model for a thin walled product and a fabricated product that can be used as part of other engineering processes	Unit 12: Engineering Drawing for Technicians 4 Be able to produce engineering drawings using a computer-aided design (CAD) system Unit 13: Computer-aided Drafting in Engineering 4 Be able to produce and interpret CAD drawings 5 Be able to use CAD software to produce 3D drawings and views

Unit 11 - Engineering Maintenance and Condition Monitoring Techniques	
A Examine the characteristics of different types of	Unit 25: Engineering Maintenance Procedures and

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<p>engineering maintenance required for engineered plant and equipment to operate safely</p>	<p>Techniques</p> <p>1 Know about the types of maintenance associated with engineering plant, equipment and systems</p> <p>2 Know about maintenance frequency, the cost of maintenance and its effects on production</p>
<p>B Examine the use of condition monitoring techniques to detect faults and potential failures before they occur</p>	<p>Unit 25: Engineering Maintenance Procedures and Techniques</p> <p>4 Understand how data gathered from monitoring the performance and condition of engineering plant, equipment and systems can be used</p> <p>Unit 26: Monitoring and Fault Diagnosis of Engineering Systems</p> <p>2 Know about system monitoring and reliability</p>
<p>C Undertake a maintenance activity safely on a piece of plant or equipment to ensure its continued safe operation</p>	<p>Unit 25: Engineering Maintenance Procedures and Techniques</p> <p>3 Be able to produce a maintenance plan for a specific engineering system</p> <p>Unit 26: Monitoring and Fault Diagnosis of Engineering Systems</p> <p>3 Be able to use monitoring and test equipment</p> <p>4 Be able to carry out fault diagnosis on engineering systems</p>

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Unit 12 - Pneumatic and Hydraulic Systems	
A Examine the safe operation and maintenance of pneumatic and hydraulic powered systems	<p>Unit 11: Electro-pneumatic and Hydraulic Systems and Devices</p> <p>1 Know about the legislation, regulations and safety precautions that apply when working with fluid power systems</p> <p>2 Know the construction and operation of fluid power devices and how they are represented as symbols in circuit diagrams</p> <p>Unit 93: Polymer Process Engineering</p> <p>2 Understand the construction and operation of hydraulic systems</p>
B Develop pneumatic and hydraulic circuit diagrams and simulate their operation	<p>Unit 11: Electro-pneumatic and Hydraulic Systems and Devices</p> <p>2 Know the construction and operation of fluid power devices and how they are represented as symbols in circuit diagrams</p>
C Explore the safe development of pneumatic or hydraulic powered systems	<p>Unit 11: Electro-pneumatic and Hydraulic Systems and Devices</p> <p>1 Know about the legislation, regulations and safety precautions that apply when working with fluid power systems</p>

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Unit 13 - Welding Technology	
A Examine common welding processes used to produce welded joints safely for different applications	<p>Unit 18: Welding Technology 1 Understand health and safety legislation, regulations and safe working practices in the welding industry</p> <p>Unit 21: Welding Principles 1 Know the physical features of welding processes</p>
B Examine weldable materials and their behaviours during the welding process	<p>Unit 18: Welding Technology 4 Understand how quality inspection processes are applied to welded joints in components</p> <p>Unit 21: Welding Principles 2 Know the effects of welding and select post-weld heat treatments 3 Understand the weldability of metals 4 Be able to use and interpret quality standards and weld testing techniques</p>
C Carry out practical welding skills safely to join metallic materials together	<p>Unit 18: Welding Technology 2 Be able to prepare for welding operations 3 Be able to produce welded joints to a quality standard</p> <p>Unit 104: Understanding and Using Fabrication Techniques for Blacksmithing and Metalworking 4 Be able to join complex components to specification within</p>

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	a product-based task
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Unit 14 - Electrical Installation of Hardware and Cables	
A Examine safety requirements based on statutory and non-statutory regulations when working with electrical installations	Unit 29: Electrical Installation 2 Understand the methods used to protect circuits 4 Know the statutory and non-statutory regulations relating to the provision of an electrical installation
B Interpret lighting and power circuit diagrams for domestic and commercial applications	Unit 29: Electrical Installation 1 Be able to interpret lighting and power circuits diagrams
C Select materials and documentation for an electrical installation	Unit 29: Electrical Installation 3 Be able to install and test lighting and power circuits
D Develop an electrical installation that incorporates different types of circuits in compliance with current regulations	Unit 29: Electrical Installation 3 Be able to install and test lighting and power circuits 4 Know the statutory and non-statutory regulations relating to the provision of an electrical installation Unit 116: Installing and Commissioning Engineering Equipment 2 Know how to install and commission electrical/electronic equipment 3 Be able to install and commission equipment used on an engineered system

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Unit 15 - Electrical Machines	
A Examine how to operate electrical machines safely to prevent injury or loss of life	Unit 1: Health and Safety in the Engineering Workplace 2 Know about hazards and risks in the workplace Unit 31: Features and Applications of Electrical Machines 1 Know the electrical hazards and the legislation, regulations and standards related to working with electrical apparatus
B Explore the safe operation of direct current electrical machines as used in industry	Unit 31: Features and Applications of Electrical Machines 3 Understand features and applications of direct current (DC) machines 4 Know how electrical machine control circuits and systems operate
C Explore the safe operation of alternating current electrical machines as used in industry	Unit 31: Features and Applications of Electrical Machines 2 Understand features and applications of alternating current (AC) machines 4 Know how electrical machine control circuits and systems operate Unit 32: Three-phase Motors and Drives 1 Know how squirrel-cage and wound rotor three-phase induction motors operate 2 Know how three-phase synchronous and synchronous-induction motors operate

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	3 Understand the function and operation of motor starters and control gear
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Unit 16 - Three Phase Electrical Systems	
A Examine the construction and operation of a national grid, which safely connects power stations and substations to supply electricity	Unit 39: Principles and Operation of Three-phase Systems 2 Know about the operation of three-phase supply systems 4 Know how three-phase power is protected and monitored and the safety requirements for working on high voltage equipment
B Explore the operation of three-phase power circuits which form the majority of electrical infrastructures globally	Unit 39: Principles and Operation of Three-phase Systems 1 Be able to use electrical relationships and determine current, voltage and power quantities for three-phase circuits 2 Know about the operation of three-phase supply systems 3 Be able to calculate parameters and carry out measurements in three-phase balanced and unbalanced loads
C Investigate the cost of using three-phase electrical power systems in typical industrial applications	N/A

Unit 17 - Power and Energy Electronics	
A Explore the construction and operation of common power	Unit 24: Principles and Applications of Electronic Devices

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electronic devices that are used to modify a form of electrical energy	and Circuits 1 Understand the function and operation of diodes, transistors and logic gates
B Explore applications of common power electronic devices that are used to modify a form of electrical energy	Unit 32: Three-phase Motors and Drives 3 Understand the function and operation of motor starters and control gear Unit 71: Principles and Applications of Analogue Electronics 2 Understand the operation of analogue electronic circuit systems and their components
C Investigate sustainable applications of power electronics	N/A

Unit 18 - Electrical Power Distribution and Transmission	
A Investigate the operation of thermal and nuclear reactor power generation that supplies electricity to the national grid	Unit 28: Electrical Technology 1 Know the methods used to produce electrical energy 3 Understand the physical arrangements of supply, transmission and distribution equipment
B Examine the design of a typical transmission network used to supply electricity	Unit 2: Communications for Engineering Technicians 3 Be able to obtain and use engineering information
C Design a distribution system to meet customer requirements for a new electrical installation	Unit 28: Electrical Technology 3 Understand the physical arrangements of supply, transmission and distribution equipment

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<p>Unit 19 - Electronic Devices and Circuits</p>	
<p>A Explore the safe operation and applications of analogue devices and circuits that form the building blocks of commercial circuits</p>	<p>Unit 23: Electronic Circuit Design and Manufacture 2 Understand the use of software techniques and thermal analysis techniques in the design, simulation and manufacture of an electronic circuit 4 Be able to design, manufacture, assemble and test a prototype printed circuit board for a given electronic circuit</p> <p>Unit 24: Principles and Applications of Electronic Devices and Circuits 1 Understand the function and operation of diodes, transistors and logic gates 2 Be able to build and test operational amplifier-based analogue circuits 4 Be able to use computer-based simulation software packages to construct and test the operation of analogue and digital circuits</p> <p>Unit 71: Principles and Applications of Analogue Electronics 1 Understand the principles of gain and loss and the function of amplifiers in analogue circuits 3 Be able to use computer-based techniques to design and</p>

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	<p>test analogue electronic circuits for specified functions 4 Be able to build and test an analogue electronic circuit Unit 73: Electronic Fault Finding 2 Be able to plan and implement a fault-finding strategy 3 Be able to diagnose fault conditions using test equipment and record the results</p>
<p>B Explore the safe operation and applications of digital logic devices and circuits that form the building blocks of commercial circuits</p>	<p>Unit 24: Principles and Applications of Electronic Devices and Circuits 1 Understand the function and operation of diodes, transistors and logic gates 3 Be able to build and test combinational and sequential logic circuits 4 Be able to use computer-based simulation software packages to construct and test the operation of analogue and digital circuits Unit 72: Construction and Applications of Digital Systems 3 Understand the selection and use of interface devices and logic devices for digital circuits 4 Be able to build and test digital systems Unit 73: Electronic Fault Finding 2 Be able to plan and implement a fault-finding strategy 3 Be able to diagnose fault conditions using test equipment</p>

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	and record the results
C Review the development of analogue and digital electronic circuits and reflect on own performance	N/A

Unit 20 - Analogue Electronic Circuits	
A Investigate through research and simulation the operation of single function analogue electronic circuits	Unit 71: Principles and Applications of Analogue Electronics 1 Understand the principles of gain and loss and the function of amplifiers in analogue circuits 2 Understand the operation of analogue electronic circuit systems and their components
B Explore the operation of single function analogue electronic circuits safely that form the building blocks of commercial circuits	Unit 24: Principles and Applications of Electronic Devices and Circuits 4 Be able to use computer-based simulation software packages to construct and test the operation of analogue and digital circuits Unit 71: Principles and Applications of Analogue Electronics 3 Be able to use computer-based techniques to design and test analogue electronic circuits for specified functions 4 Be able to build and test an analogue electronic circuit

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C Modify a single function analogue electronic circuit to meet given parameters as widely undertaken in industry	<p>Unit 24: Principles and Applications of Electronic Devices and Circuits</p> <p>4 Be able to use computer-based simulation software packages to construct and test the operation of analogue and digital circuits</p> <p>Unit 71: Principles and Applications of Analogue Electronics</p> <p>3 Be able to use computer-based techniques to design and test analogue electronic circuits for specified functions</p> <p>4 Be able to build and test an analogue electronic circuit</p>
D Review the development of analogue electronic circuits and reflect on own performance	N/A

Unit 21 - Electronic Measurement and Testing of Circuits	
A Explore the operational features of common electronic test devices used to measure and test signals in electronic circuits	<p>Unit 30: Electronic Measurement and Testing</p> <p>1 Understand the function, features and characteristics of electronic measurement and test equipment</p>
B Examine fault finding techniques and test plans used when measuring and testing electronic circuits	<p>Unit 73: Electronic Fault Finding</p> <p>2 Be able to plan and implement a fault-finding strategy</p>
C Carry out measurements and tests on analogue and digital	Unit 30: Electronic Measurement and Testing

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electronic circuits to identify faults safely	<p>2 Be able to select and use electronic measurement and test equipment to make meaningful measurements on an electronic circuit</p> <p>3 Know the principles of calibration and configuration of electronic test equipment</p> <p>Unit 73: Electronic Fault Finding</p> <p>3 Be able to diagnose fault conditions using test equipment and record the results</p>
D Review the measurement and testing of electronic circuits and reflect on own performance	N/A

Unit 22 - Electronic Printed Circuit Board Design and Manufacture	
A Examine the design and manufacture of printed circuit boards that are widely used in industry	<p>Unit 23: Electronic Circuit Design and Manufacture</p> <p>1 Know the design processes and production methods used in the manufacture of a printed circuit board</p> <p>3 Understand the use and application of surface mount technology in the manufacture of an electronic circuit</p>
B Explore how computer software is used for schematic capture and simulation of an electronic circuit	<p>Unit 23: Electronic Circuit Design and Manufacture</p> <p>2 Understand the use of software techniques and thermal analysis techniques in the design, simulation and manufacture of an electronic circuit</p>

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C Develop safely a printed circuit board to solve an engineering problem	Unit 23: Electronic Circuit Design and Manufacture 4 Be able to design, manufacture, assemble and test a prototype printed circuit board for a given electronic circuit
D Review the development of the printed circuit board and reflect on own performance	N/A

Unit 23 - Digital and Analogue Electronic Systems	
A Examine the principles of analogue and digital electronic systems as applied in industry	Unit 27: Principles and Applications of Engineering Measurement Systems 1 Understand the applications of common measurement systems
B Explore the characteristics of analogue, digital and mixed electronic systems, and the role of signal conversion in control applications	Unit 27: Principles and Applications of Engineering Measurement Systems 2 Understand the operation of measurement system components Unit 72: Construction and Applications of Digital Systems 2 Understand the transmission of analogue data in a digital system Unit 102: Industrial Process Measurement 2 Know about the operation and application of signal processing systems

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C Carry out fault finding safely on complex electronic systems as applied in industry	Unit 73: Electronic Fault Finding 2 Be able to plan and implement a fault-finding strategy 3 Be able to diagnose fault conditions using test equipment and record the results
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Unit 24 - Maintenance of Mechanical Systems	
A Examine the characteristics of lubricants and their application in mechanical systems	Unit 9: Applications of Mechanical Systems in Engineering 1 Understand the purposes and uses of lubricants and lubrication systems
B Investigate the characteristics and applications of common consumable components used in mechanical systems	Unit 9: Applications of Mechanical Systems in Engineering 2 Know about the uses and applications of a range of engineering components
C Investigate the operation and application of power transmission components used in mechanical systems	Unit 9: Applications of Mechanical Systems in Engineering 3 Understand the operation and uses of mechanical power transmission systems Unit 93: Polymer Process Engineering 1 Understand the principles of mechanical drive systems
D Carry out routine maintenance safely and sustainably to	N/A

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help ensure the continued operation of a mechanical system	
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Unit 25 - Mechanical Behaviour of Metallic Materials	
A Investigate the microstructures of metallic materials, the effects of processing on them and how these effects influence their mechanical properties	Unit 7: Properties and Applications of Engineering Materials 1 Know the structure and classification of engineering materials 2 Understand material properties and the effects of processing on the structure and behaviour of engineering materials
B Explore safely the mechanical properties of metallic materials and the impact on their in-service requirements	Unit 7: Properties and Applications of Engineering Materials 2 Understand material properties and the effects of processing on the structure and behaviour of engineering materials 4 Understand about the modes of failure of engineering materials Unit 103: Understanding and Using Fabrication Skills for Blacksmithing and Metalworking 1 Know the metals and associated forms of supply commonly used in fabrication processes
C Explore the in-service failure of metallic components and	Unit 7: Properties and Applications of Engineering

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consider improvements to their design	Materials 4 Understand about the modes of failure of engineering materials
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Unit 26 - Mechanical Behaviour of Non-metallic Materials	
A Investigate how the structures of non-metallic materials influence their mechanical properties	Unit 7: Properties and Applications of Engineering Materials 1 Know the structure and classification of engineering materials
B Explore safely the mechanical properties of non-metallic materials and the impact of structural defects on them	Unit 7: Properties and Applications of Engineering Materials 2 Understand material properties and the effects of processing on the structure and behaviour of engineering materials 4 Understand about the modes of failure of engineering materials Unit 94: Composite Materials and Processing 5 Be able to test composite materials to determine their structural integrity and properties
C Explore the in-service failure of non-metallic components and consider improvements to their design	Unit 7: Properties and Applications of Engineering Materials 4 Understand about the modes of failure of engineering

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	materials
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Unit 27 - Static Mechanical Principles in Practice	
A Examine how the forces acting in pin-jointed framed structures influence their structural integrity	Unit 55: Further Mechanical Principles and Applications 1 Be able to determine the forces acting in pin-jointed framed structures and simply supported beams
B Explore safely the shear forces and bending moments in simply supported and cantilever beams	Unit 8: Mechanical Principles of Engineering Systems 1 Be able to determine the effects of loading in static engineering systems Unit 55: Further Mechanical Principles and Applications 1 Be able to determine the forces acting in pin-jointed framed structures and simply supported beams 2 Be able to determine the stress in structural members and joints
C Examine how axial, bending and shear loading affect the design of structural components	Unit 8: Mechanical Principles of Engineering Systems 1 Be able to determine the effects of loading in static engineering systems Unit 14: Advanced Mechanical Principles and Applications 1 Be able to determine the effects of uniaxial and complex loading on engineering components 2 Be able to determine the stress due to bending in beams

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	<p>and torsion in power transmission shafts</p> <p>Unit 55: Further Mechanical Principles and Applications</p> <p>2 Be able to determine the stress in structural members and joints</p>
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Unit 28 - Dynamic Mechanical Principles in Practice	
A Explore the dynamic characteristics of linear and rotational motion that are applied in mechanical systems	<p>Unit 8: Mechanical Principles of Engineering Systems</p> <p>2 Be able to determine work, power and energy transfer in dynamic engineering systems</p> <p>Unit 55: Further Mechanical Principles and Applications</p> <p>3 Be able to determine the characteristics of rotating systems</p>
B Investigate the characteristics of uniform centripetal acceleration that is applied in mechanical systems	<p>Unit 55: Further Mechanical Principles and Applications</p> <p>3 Be able to determine the characteristics of rotating systems</p>
C Explore the characteristics of lifting machines, relative velocity and periodic motion that are applied in mechanical systems	<p>Unit 14: Advanced Mechanical Principles and Applications</p> <p>3 Be able to determine relative and resultant velocity in engineering systems</p> <p>4 Be able to determine the characteristics of simple harmonic motion in engineering systems</p> <p>Unit 55: Further Mechanical Principles and Applications</p> <p>4 Be able to determine the operating characteristics of simple lifting machines</p>

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Unit 29 - Principles and Applications of Fluid Mechanics	
A Examine the application of static fluid principles that power hydrostatic and pneumatic components and systems	Unit 66: Principles and Applications of Fluid Mechanics 1 Understand the physical properties and characteristic behaviour of fluids and determine system parameters for lubricated bearings 2 Be able to determine the parameters that act in hydrostatic devices and act on immersed surfaces
B Explore the application of dynamic fluid principles to internal fluid flows and measurement systems	Unit 66: Principles and Applications of Fluid Mechanics 3 Be able to apply fluid flow theory to determine parameters for piped measuring systems and nozzle vane systems
C Examine the application of fluid linear momentum principles to nozzle systems and fluid turbine operation	Unit 66: Principles and Applications of Fluid Mechanics 3 Be able to apply fluid flow theory to determine parameters for piped measuring systems and nozzle vane systems

Unit 30 - Mechanical Measurement and Inspection Technology	
A Explore the principles applied to mechanical measurement and inspection methods as used in industry	Unit 43: Mechanical Measurement and Inspection Techniques 1 Understand principles and applications of mechanical measurement

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B Carry out mechanical measurement and inspection methods to determine if components are fit for purpose	Unit 43: Mechanical Measurement and Inspection Techniques 2 Be able to use measurement equipment and techniques 3 Be able to use comparators and design a gauging system for inspection
C Explore statistical process control to inspect components and increase productivity	Unit 43: Mechanical Measurement and Inspection Techniques 4 Be able to apply sampling and statistical process control (SPC) during inspection Unit 69: Statistics and Business Improvement Techniques 3 Be able to apply basic statistical techniques and statistical process control procedures
D Carry out a process capability study to establish machine suitability for a given application	Unit 69: Statistics and Business Improvement Techniques 4 Be able to carry out a process capability study

Unit 31 - Thermodynamic Principles and Practice	
A Investigate thermodynamic principles related to the expansion and compression of gases that are applied in mechanical systems	Unit 8: Mechanical Principles of Engineering Systems 4 Be able to determine the effects of energy transfer in thermodynamic systems Unit 70: Applications of Thermodynamic Principles 1 Be able to apply thermodynamic principles to the expansion and compression of gases

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B Investigate energy transfer in thermodynamic systems and applications of open- and closed-loop systems	Unit 8: Mechanical Principles of Engineering Systems 4 Be able to determine the effects of energy transfer in thermodynamic systems Unit 70: Applications of Thermodynamic Principles 2 Be able to quantify energy transfer in thermodynamic systems 4 Be able to quantify energy transfer in steam plant
C Explore the combustion and sustainability of fuels that are used to produce work in mechanical systems	Unit 70: Applications of Thermodynamic Principles 3 Be able to determine combustion process requirements and the calorific value of fuels

Unit 32 - Computer System Principles and Practice	
A Examine the technology and security protection measures used in computer systems for different applications	N/A
B Examine how data is represented and manipulated in microprocessors to appreciate how computer systems function	N/A
C Examine the architecture and operation of microprocessors to appreciate how computer systems function	N/A
D Develop a computer program to solve an engineering	N/A

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related problem onscreen	
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Unit 34 - Computer Systems Support and Performance	
A Examine the computer support needs for different engineering organisations that are essential to their operation	N/A
B Develop a support plan for a new computer system, as undertaken in industry	N/A
C Carry out routine support of a computer system and improve its performance	N/A
D Review the support provided for a computer system and reflect on own performance	N/A

Unit 35 - Computer Programming	
A Examine the project structures and methods used in the development of software programs	N/A
B Design a software program based on user requirements to solve a problem	Unit 113: Autonomous Systems 3 Be able to develop an autonomous bot for an advanced manufacturing application
C Develop a software program to solve a problem	Unit 113: Autonomous Systems

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	3 Be able to develop an autonomous bot for an advanced manufacturing application
D Review and reflect on own performance for the development of a software program	N/A

Unit 36 - Programmable Logic Controllers	
A Investigate the technology used in industrial Programmable Logic Controller systems	Unit 19: Selecting and Using Programmable Controllers 1 Understand the selection, hardware and software requirements of a programmable controller Unit 38: Industrial Process Controllers 3 Know about the types and operation of programmable logic controllers
B Explore programming structures and methods to control Programmable Logic Controllers	Unit 19: Selecting and Using Programmable Controllers 2 Be able to use programming techniques to produce a program for a modern programmable controller Unit 38: Industrial Process Controllers 4 Be able to write and fault-find programmable logic controller programs
C Develop an industrial Programmable Logic Controller system to solve an engineering problem	N/A
D Review the development of an industrial control system	N/A

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and reflect on own performance	
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Unit 37 - Computer Networks	
A Examine the types, applications, technologies, and security of computer networks used in engineering	Unit 108: Industry 4.0 3 Understand the range of technologies that enable Industry 4.0 and their benefits
B Plan the implementation of a secure computer network infrastructure to meet a client brief	N/A
C Develop a secure computer network infrastructure to meet a client brief	N/A

Unit 38 - Website Production to Control Devices	
A Investigate the technology used in website applications for controlling physical devices across the internet	N/A
B Investigate security measures used to protect website applications from malicious attacks	N/A
C Design a website application to remotely control a physical device across the internet	N/A
D Develop a website application to remotely control a physical device across the internet	N/A

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Unit 39 - Modern Manufacturing Systems	
A Understand the functions of manufacturing operations and factors influencing their success	N/A
B Examine process systems that are commonly used in manufacturing industry	Unit 34: Manufacturing Planning 1 Understand the techniques and policies used to improve product manufacturing efficiency
C Investigate the principles of Lean manufacturing and how these influence productivity	Unit 68: Lean Production System Design 1 Know the principles of lean manufacturing 2 Know how to create a flexible production system 4 Know how to implement a total productive maintenance system

Unit 40 - Computer Aided Manufacturing and Planning	
A Examine the benefits, technology and applications of computer-aided manufacturing systems that improve the operation	Unit 22: Computer-aided Manufacturing 1 Understand the benefits of CAM and the significance of simultaneous engineering 3 Understand the use of industrial robots and flexible manufacturing systems in engineering
B Develop a virtual component on a computer-aided manufacturing system that simulates its manufacture	Unit 20: Applications of Computer Numerical Control in Engineering 4 Be able to use a CAD/CAM software package to generate a

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	<p>part program and manufacture a component</p> <p>Unit 22: Computer-aided Manufacturing</p> <p>2 Understand how the CAD/CAM interface operates and modelling is used to simulate the manufacturing process</p> <p>Unit 110: Simulation and Digital Twinning</p> <p>3 Be able to produce and simulate a digital twin for a manufacturing process or system</p>
C Investigate planning documentation used to optimise the workflow and initiate manufacture in the operation	<p>Unit 34: Manufacturing Planning</p> <p>2 Understand general aspects of planning and control</p> <p>3 Be able to use a product specification to produce a production plan</p> <p>4 Be able to produce a production schedule</p>

Unit 41 - Manufacturing Secondary Machining Processes	
A Examine the technology and characteristics of secondary machining processes that are widely used in industry	<p>Unit 16: Engineering Secondary and Finishing Techniques</p> <p>1 Understand how a range of secondary machining techniques are used</p> <p>2 Know how a range of non-traditional techniques are used</p> <p>Unit 35: Setting and Proving Secondary Processing Machines</p> <p>1 Know how traditional and specialist secondary processing machines function</p>

<p>B Set up traditional secondary processing machines to manufacture a component safely</p>	<p>Unit 1: Health and Safety in the Engineering Workplace 2 Know about hazards and risks in the workplace Unit 35: Setting and Proving Secondary Processing Machines 3 Be able to safely set up a secondary processing machine to accurately make a component</p>
<p>C Carry out traditional secondary machining processes to manufacture a component safely</p>	<p>Unit 35: Setting and Proving Secondary Processing Machines 3 Be able to safely set up a secondary processing machine to accurately make a component</p>
<p>D Review the processes used to machine a component and reflect on personal performance</p>	<p>Unit 16: Engineering Secondary and Finishing Techniques 1 Understand how a range of secondary machining techniques are used Unit 35: Setting and Proving Secondary Processing Machines 2 Understand how work-holding devices, tools and machine parameters are set up to produce a range of components</p>

<p>Unit 42 - Manufacturing Primary Forming Processes</p>	
<p>A Examine how moulding processes involving metals, ceramics and polymers are used in industry</p>	<p>Unit 15: Engineering Primary Forming Processes 1 Understand how moulding techniques involving metals, ceramics and polymers are used</p>

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	Unit 92: Plastics Processing 1 Know the moulding techniques used for manufacture of plastic products
B Examine how deformation processes involving metals and polymers are used in industry	Unit 15: Engineering Primary Forming Processes 2 Understand how deformation processes involving metals and polymers are used
C Investigate the suitability of forming processes to manufacture products using safe working practices	Unit 15: Engineering Primary Forming Processes 1 Understand how moulding techniques involving metals, ceramics and polymers are used 2 Understand how deformation processes involving metals and polymers are used 4 Understand how health and safety issues relate to primary forming processes

Unit 43 - Manufacturing Computer Numerical Control Machining Processes	
A Examine the control systems used in Computer Numerical Control machines and different computer programming methods	Unit 20: Applications of Computer Numerical Control in Engineering 1 Understand the principles of computer numerical control (CNC) and machine structures
B Develop a Computer Numerical Control set-up sheet and	Unit 20: Applications of Computer Numerical Control in

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<p>part program to manufacture a component safely</p>	<p>Engineering 2 Be able to interpret a component specification and produce an operational plan for its manufacture 3 Be able to produce a part program and manufacture a component 4 Be able to use a CAD/CAM software package to generate a part program and manufacture a component Unit 22: Computer-aided Manufacturing 4 Be able to design a simple component and generate a programme for a CNC machine using a CAD/ CAM software package</p>
<p>C Carry out Computer Numerical Control machining processes to manufacture a component safely</p>	<p>Unit 20: Applications of Computer Numerical Control in Engineering 3 Be able to produce a part program and manufacture a component 4 Be able to use a CAD/CAM software package to generate a part program and manufacture a component Unit 43: Mechanical Measurement and Inspection Techniques 2 Be able to use measurement equipment and techniques</p>
<p>D Review the processes used to machine a component and reflect on personal performance</p>	<p>N/A</p>

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Unit 44 - Fabrication Manufacturing Processes	
A Examine the processes and technology used in sheet metal fabrication that are widely used in industry	Unit 17: Fabrication Processes and Technology 2 Know the processes used to mark out and prepare materials to produce fabricated structures 3 Know how materials are formed and assembled to produce fabricated structures
B Carry out the preparation necessary to manufacture a fabricated product safely	Unit 17: Fabrication Processes and Technology 1 Understand health and safety legislation, regulations and safe working practices for fabrication activities 4 Be able to interpret the specification of a fabricated structure and plan and carry out its manufacture Unit 103: Understanding and Using Fabrication Skills for Blacksmithing and Metalworking 2 Be able to mark out and cut to a parallel line development specification
C Carry out fabrication processes to manufacture a fabricated product safely	Unit 17: Fabrication Processes and Technology 4 Be able to interpret the specification of a fabricated structure and plan and carry out its manufacture Unit 43: Mechanical Measurement and Inspection Techniques 2 Be able to use measurement equipment and techniques

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	<p>Unit 103: Understanding and Using Fabrication Skills for Blacksmithing and Metalworking</p> <p>3 Be able to use fabrication bending and forming methods, equipment and machinery to produce a parallel line development sheet fabrication</p> <p>4 Be able to use fabrication joining methods and equipment to create a parallel line development sheet fabrication</p> <p>Unit 104: Understanding and Using Fabrication Techniques for Blacksmithing and Metalworking</p> <p>2 Be able to cut complex components to specification within a product-based task</p> <p>3 Be able to form and bend complex components to specification within a product-based task</p> <p>4 Be able to join complex components to specification within a product-based task</p>
D Review the processes used to manufacture a fabricated product and reflect on personal performance	N/A

Unit 46 - Manufacturing Joining, Finishing and Assembly Processes	
A Explore the joining processes that are often used to connect components into sub-assemblies and products	<p>Unit 1: Health and Safety in the Engineering Workplace</p> <p>1 Understand health and safety legislation and regulations</p>

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	<p>Unit 9: Applications of Mechanical Systems in Engineering 2 Know about the uses and applications of a range of engineering components</p> <p>Unit 16: Engineering Secondary and Finishing Techniques 3 Know how heat treatment processes and assembly techniques are used</p> <p>Unit 17: Fabrication Processes and Technology 3 Know how materials are formed and assembled to produce fabricated structures</p>
B Explore the finishing processes that are used to improve the appearance and function of products	<p>Unit 1: Health and Safety in the Engineering Workplace 1 Understand health and safety legislation and regulations</p> <p>Unit 16: Engineering Secondary and Finishing Techniques 4 Know how finishing techniques are used</p>
C Investigate the processes used to assemble products and the economic and social consequences associated with them	<p>Unit 16: Engineering Secondary and Finishing Techniques 3 Know how heat treatment processes and assembly techniques are used</p> <p>Unit 22: Computer-aided Manufacturing 3 Understand the use of industrial robots and flexible manufacturing systems in engineering</p>

Unit 47 - Composites Manufacture and Repair Processes

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<p>A Examine the characteristics and applications of fibre-reinforced polymer composites that are widely used in industry</p>	<p>Unit 74: Advanced Composite Materials Manufacturing 1 Know the different types of matrices and reinforcements commonly used in composite manufacture</p> <p>Unit 94: Composite Materials and Processing 1 Know the structures, resins, reinforcements and properties of composite materials</p>
<p>B Investigate the processes used to manufacture and repair fibre-reinforced polymer composites</p>	<p>Unit 15: Engineering Primary Forming Processes 3 Understand how shaping and assembly processes involving composites are used</p> <p>Unit 59: Airframe Construction and Repair B Examine how inspection and repair methods are used in the maintenance of composite airframes and components</p> <p>Unit 74: Advanced Composite Materials Manufacturing 2 Understand the differences, advantages and disadvantages of key manufacturing processes 3 Understand the effects of design decisions on component manufacturability 4 Understand bonding processes, finishing processes, inspection and repair techniques</p> <p>Unit 94: Composite Materials and Processing 2 Know the various processing methods used to produce composite components and the relevant safety</p>

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	<p>considerations required</p> <p>3 Know the effects of processing on composite materials, including the variables that need to be controlled</p>
C Carry out processes to manufacture and repair fibre-reinforced polymer composite components	<p>Unit 59: Airframe Construction and Repair</p> <p>C Carry out processes to inspect and repair safely an airframe composite structure or components that will help to ensure airworthiness</p>

Unit 56 - Industrial Robotics	
A Investigate the health and safety and maintenance requirements associated with industrial robots	<p>Unit 40: Industrial Robot Technology</p> <p>4 Know the hazards and health, safety and maintenance requirements associated with industrial robots and robot work cells</p>
B Investigate the operation and design of industrial robots for different applications	<p>Unit 40: Industrial Robot Technology</p> <p>1 Understand the operating, design and control principles of modern industrial robots and robot work cells</p> <p>Unit 93: Polymer Process Engineering</p> <p>4 Understand the different types and applications of industrial robots</p>
C Investigate the operation of industrial robot sensors and end effectors	<p>Unit 40: Industrial Robot Technology</p> <p>2 Understand the operating principles of industrial robot</p>

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	sensors and end effectors
D Produce a program for an industrial robot to solve an engineering problem	Unit 40: Industrial Robot Technology 3 Be able to produce a working program for an industrial robot or robot work cell

Unit 57 - Sustainable Transport	
A Investigate the sustainability of alternative power sources for transport vehicles	N/A
B Investigate the wider benefits of reducing the distance travelled by transport vehicles	N/A
C Investigate how barriers to use, incentives and penalties could affect the demand for sustainable vehicle transport	N/A
D Investigate ways to improve the sustainability of leisure travel	N/A

Unit 58 - Energy Management	
A Know about energy management	Unit 114: Environmental Engineering and Sustainability 1 Know about sustainability in engineering
B Be able to plan for an energy management audit	N/A
C Be able to conduct an energy management audit	N/A

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D Understand how to monitor and target energy savings	N/A
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