Year 12 Curriculum intent – 2022-23

	Autumn Term		Spring Term		Summer Term	
	1	**2**	**1**	**2**	**1**	**1**
Key Concepts	Unit 1	Unit 2	Unit 1	Unit 2	Unit 1	Unit 2
Knowledge & understanding	Section A- Applied Mathematics	Unit 2A Examine common engineering processes to create products or deliver services safely and effectively as a team	Section B- Mechanical Principles	Unit 2B Develop two-dimensional computer-aided drawings that can be used in engineering processes	Section C- Electrical and Electronic Principles	Unit 2 Carry out engineering processes safely to manufacture a product or to deliver a service effectively as a team.
Assessment	End of Unit Assessment & mock exams	Unit 2A Coursework	End of Unit Assessment & mock exams	Unit 2B Coursework	Summer Exam series Unit 1	Unit 2C Coursework All coursework to be sent to exam board
Why this? Why now?	Unit 1 Modern life depends on engineers to develop, support, and control the products and systems that are all around us. For example, cars, heart rate monitors and manufacturing and transport systems. To contribute as an engineer you must be able to draw on an important range of principles developed by early engineering scientists, such as Newton, Young, Faraday and Ohm. There is an increasing demand for 'multi-skilled' engineers who can apply principles from several engineering disciplines to				Unit 2 The use of engineering processes is integral to the manufacture of engineered products and the delivery of engineering services. Thousands of engineering processes are used in the manufacture and service of a complex product, such as an aeroplane. To ensure that these engineering processes can be planned and carried out safely and effectively, engineers must be able to work together to get the job done. It is for this reason that so many engineering companies focus time and effort on understanding engineering processes and developing teamwork. In this unit,	

	develop solutions. This unit will develop your mathematical and physical scientific knowledge and understanding to enable you to solve problems set in an engineering context. You will explore and apply the algebraic and trigonometric mathematical methods required to solve engineering problems. The mechanical problems you will encounter cover static, dynamic and fluid systems. The electrical and electronic problems you will encounter cover static and direct current (DC) electricity, DC circuit theory and networks, magnetism, and single-phase alternating current theory. You may apply these engineering principles to solve problems involving more than one of these topic areas. This unit is externally assessed. It sits at the heart of the qualification and gives you a foundation to support you in any engineering technician role, an engineering apprenticeship or in higher education.	you will examine common engineering processes, including health and safety legislation, regulations that apply to these processes and how individual and team performance can be affected by human factors. You will learn the principles of another important process, engineering drawing, and develop two-dimensional (2D) computer-aided drawing skills while producing orthographic projections and circuit diagrams. Finally, you will work as a team member and team leader to apply a range of practical engineering processes to manufacture a batch of an engineered product or to safely deliver a batch of an engineering service. To complete the assessment task within this unit, you will need to draw on your learning from across your programme. It is important that engineers understand how engineering processes are used to safely transform ideas and materials into products and services, and how critical it is to be able to work as a valuable member of an effective team or as a team leader. This unit will enable you to apply the knowledge and understanding you gained in Unit 1: Engineering Principles. The unit will help to prepare you for an engineering apprenticeship, a higher education engineering degree or a technician-level role in a wide range of specialist engineering areas.
Skills & Characteristics	Unit 1- Mathematical, Analytical, Problem Solving, Investigating, Communication Unit 2- IT, Teamwork, Measuring, Marking, Reading, Distilling, CAD, Communication, Literacy, Health and Safety, Distilling	
Aspirations & Careers	Tradesman: Electrician, Plumer, Joiner, Builder. Engineer: Materials, Civil, Automotive, Design, Chemical, Clinical, Games Designer, Graphic Designer, Product Designer, Construction Manager CAD Technician, Secondary School Teacher, Data Analysis	
End points	Unit 1 Pass Learners are able to use and apply basic electrical, electronic, mechanical, and mathematical principles to solve simple and familiar engineering and mathematical problems directly. They	Unit 1 Pass- A, B, C A- For pass standard, learners will produce evidence that shows they understand how three common engineering processes are used to manufacture a product or deliver a

	can provide responses showing understanding and analysis of basic and familiar engineering problems. They can interpret and analyse diagrams, graphical information, and systems, using their knowledge and understanding to solve basic and familiar problems. They can select and implement appropriate basic procedures to provide solutions for given mathematical and engineering situations. They often use appropriate engineering and mathematical terminology and units. Unit 1 Distinction Learners are able to use and apply advanced electrical, electronic, mechanical, and mathematical principles to solve complex and unfamiliar engineering and mathematical problems directly, indirectly, and synoptically. They can provide balanced responses showing developed understanding and evaluation of complex familiar and unfamiliar engineering problems. They can interpret and evaluate diagrams, graphical information, and systems, using their knowledge and understanding to solve complex familiar and unfamiliar problems. They can select and implement appropriate advanced procedures to provide justified and optimised solutions for given engineering and mathematical situations. They use appropriate and technically accurate engineering and mathematical terminology consistently. Learners can propose solutions to problems, drawing on their knowledge and understanding of electrical, electronic, mechanical, and mathematical principles.	service. The evidence will be factually accurate and will include clear references to health and safety legislation and regulations, for example how drilling, turning, and milling are used to produce a given product/products, or how to dismantle and replace worn parts and test an item using safe working practices and personal protective equipment, including why and how to report a dangerous occurrence during a process. Learners will also produce evidence that shows they recognise the impact that human factors, either as an individual or as a team, can have on the three common engineering processes, for example the productivity of the processes being affected by an individual's attitude or capability, or safety being affected by fatigue. Overall, the explanations may be basic in parts and may have some inaccuracies relating to engineering terminology. B- For pass standard, learners will produce elevations that are technically correct but there may be some errors, such as a repeated dimension or inaccurate annotation. Overall, all details in the 2D CAD orthographic projection drawing and the electric circuit diagram must be suitable for a competent third party to manufacture the component or the electric circuit from the drawings. C- For pass standard, learners will manage their contribution to making decisions concerning the allocation of roles and responsibilities, time planning and setting team targets. These activities will be completed as a minimum to set up and organise the team to manufacture a batch of an engineered product or to deliver a batch of an engineered service. It will be essential to ensure that each team member has clear

		responsibilities and that everyone contributes to the end result during the manufacture of a batch of an engineered product or the delivery of a batch of an engineering service. All individual team members must be clear about who is responsible and accountable for each aspect of the work, and team targets should be set and reviewed. To facilitate this, each team must carry out a series of meetings both prior to and during the manufacture of a batch of an engineered product or the delivery of a batch of an engineering service. Each member of the team must produce their own evidence against the assessment criteria, as evidence cannot be shared. Learners will produce their own risk assessment to show how health and safety is managed in the engineering workplace, for at least one engineering process to be used when manufacturing the engineered product or when delivering the engineering service. The risk assessment should consider the most significant hazards with details of suitable control measures and be laid out on an appropriate industry-standard template. It will be appropriate but may lack detail. For example, it may focus on the more obvious hazards and control measures, including those already in place. Learners will also interpret technical documentation, including a production plan and an engineering drawing given to them, to set up safely at least one engineering process, for example, so that they can carry out the process in a consistent manner. During the delivery of manufacturing or service processes, learners will show that they can act independently as a team member and as a team leader to make progress towards team targets, although learners may demonstrate some reluctance to adapt to changing circumstances. The products or services delivered by the team do not have to be accurate and do not

		need to be tested for functionality, but teams must keep quality records. For example, the dimensions of a hole would be checked for conformance against the technical documentation and notes would be made on the outcome of the quality check. Also, teams do not need to rework any non-conforming product or service outcomes. Overall, the evidence will be logically structured but may be imprecise and basic in some parts, meaning that only a third party with technical knowledge can understand aspects of it. Unit 1 Distinction- A, B, C A- For distinction standard, learners will produce evidence that evaluates the relative merits of using different common engineering processes to manufacture a given product or deliver a given service, by comparing and contrasting the advantages and limitations of the chosen processes and of using other possible processes. Learners will provide detailed and justified reasons as to which processes are most effective, by referring to the specific requirements of the given product or service, for example by considering why a product is cast rather than machined, or whether to test or disassemble at a given interval. Learners will also produce evidence that shows they can evaluate the impact that a range of human factors, as an individual and as a team, can have on the performance of engineering processes, for example, how coercion by someone in authority could lead to an individual or team introducing unnecessary hazards and risks into the engineering processes. Overall, the evidence will be easy to read by a third party, who may or may not be an engineer, and will be easily understood. It will be logically structured and will use correct technical

		engineering terms with a high standard of written language, i.e., consistent use of correct grammar and spelling. B- For distinction standard, learners will show in their evidence that they used a full range of CAD commands when generating the drawings and prepared and used additional layers as required for the drawing template, dimensioning and annotation. Overall, all details in the 2D CAD orthographic projection and the electrical circuit diagram must be produced to typically represent the standards found in BS 8888 and BS 60617 (or other relevant international equivalents), with no omissions or errors evident. C- For distinction standard, learners will consistently demonstrate at least one of the following traits during the planning and manufacturing or service activities: forward thinking, adaptability, or initiative. For example, learners may respond to opportunities as they arise by convincing the team to adopt a more efficient approach to the manufacturing or service activities, or a different approach if a lack of equipment or resources demands it, or they may adapt to circumstances quickly by providing feedback to team members or by coaching others who are struggling with an activity or process. Learners may also prove their capability to adapt a process and/or machines to manufacture quantities of a product, for example by setting stops or by using simple techniques to process components at the same time. Similar approaches could be used in the delivery of a batch of an engineering service. Learners will show their ability to objectively review team targets at suitable points and reach agreements with other team members as to an appropriate way forward given

		current progress. Overall, the evidence should be presented clearly and in a way that would be understood by a third party who may or may not be an engineer.

Year 13 Curriculum intent – 2022-23

	Autumn Term		Spring Term		Summer Term	
	1	2	1	2	1	2
Key Concepts	Unit 3 Unit 45 A	Unit 3 Unit 45 B	Unit 3 Engineering	Unit 3 Engineering Unit 45 C	Revision	
Knowledge & understanding	Unit 3 Engineering Product Design and Manufacture Unit 45 A Examine the technology and characteristics of additive manufacturing processes as used in industry	Unit 3 Engineering Product Design and Manufacture Unit 45 B Investigate component design considerations and finishing processes required to effectively use additive manufacturing processes	Unit 3 Engineering Product Design and Manufacture	Unit 3 Engineering Product Design and Manufacture Unit 45 C Develop a component using additive manufacturing processes safely.		
Assessment	Unit 3A Coursework	Unit 3B Coursework	Unit 1 Exam winter series (Resit) Unit 3 Exam winter series	Unit 3C Coursework All coursework to be sent to exam board	Unit 3 Summer series	

Why this? **Why now?**	Unit 3 Engineering products are part of our daily lives, from aircraft to the smallest electronic circuits found in medical devices. Engineering products are designed as a result of the identification of a need or opportunity, and then engineers using creative skills and technical knowledge to devise and deliver a new design or improvements to an existing design. For example, advances in the development of fuels led to the first internal combustion engine, and engineers have been improving its design ever since. In this unit, you will examine what triggers changes in the design of engineering products and the typical challenges that engineers face, such as designing out safety risks. You will learn how material properties and manufacturing processes impact on the design of an engineering product. Finally, you will use an iterative process to develop a design for an engineering product by interpreting a brief, producing initial ideas, and then communicating and justifying your	Unit 45 Additive manufacturing (AM) processes are set to revolutionise the manufacturing industry and provide mass customisation of products and components for consumers. For example, a human jawbone can be manufactured to the exact specification of a patient needing a transplant. In addition, additive processes are more sustainable than traditional subtractive manufacturing processes, such as computer numeric controlled machining. In this unit, you will examine the technology and characteristics of the additive and finishing processes that are needed to manufacture a product or component. You will investigate design changes required to move from a traditional manufacturing process, such as machining and casting, to an additive process and the additional finishing processes that may be needed as a result. Finally, you will design a component that is suitable for manufacture using an additive process and manufacture your component using a 3D printer. Technology is transforming our lives; therefore, as an engineer it is	

	suggested solution. You will draw on and apply knowledge and understanding from Unit 1: Engineering Principles and Unit 2: Delivery of Engineering Processes Safely as a Team, for example by using calculations to demonstrate a reduction in mass, by sketching using orthographic projection drawing methods or by justifying an engineering process as its use reduces the carbon footprint of a product. To complete the assessment task within this unit, you will need to draw on your learning from across your programme. It is important that engineers use creative and technical knowledge, understanding and skills to transform ideas into viable products, and that they understand the critical importance of this activity in ensuring that products are both safe and effective. This unit will help prepare you for an engineering apprenticeship, engineering courses in higher education or for technician-level roles in a variety of engineering sectors.	important that you understand the new manufacturing processes that are providing opportunities in product design, mass customisation and sustainability. In the United Kingdom, additive AM processes have been estimated to be worth around £6 billion per annum and are expected to employ 63 000 people by 2020. This unit helps to prepare you for employment, for example as a manufacturing engineering technician, for an apprenticeship, or for entry to higher education to study, for example, manufacturing engineering.	

Skills & Characteristics	Unit 3 Commitment, effective communication and interpersonal skills, observation skills, professionalism, problem-solving skills, teamwork, reflective practitioner, marking, measuring, drawing, sketching. Unit 45 Commitment, effective communication and interpersonal skills, observation skills, professionalism, problem-solving skills, teamwork, reflective practitioner, marking, measuring.			
Aspirations & Careers	Tradesman: Electrician, Plumer, Joiner, Builder. Engineer: Materials, Civil, Automotive, Design, Chemical, Clinical, Games Designer, Graphic Designer, Product Designer, Construction Manager CAD Technician, Secondary School Teacher, Data Analysis			
End points	Unit 3 Pass Learners demonstrate knowledge and understanding of iterative design methodologies, processes, features and procedures and their application to engineering products. They can interpret a design brief to generate ideas and will deploy skills and selected techniques to develop modified products in context. Learners demonstrate research and analytical skills in order to create a product design specification to meet the requirements of a brief. They make recommendations and proposals relevant to familiar and unfamiliar situations, with consideration of design sustainability and safety issues. Learners will make evaluative judgements in relation to their design proposal and be able to provide technical justifications in the validation of their design solution	Unit 45 Pass A, B, C A-For pass standard, learners will explain how at least two AM processes are used to manufacture components safely and sustainably. For example, the wire deposition process uses a high-powered laser to deposit molten material layer by layer into the shape of a component and inert gas is used to shield the material. Appropriate machine guarding is needed to protect operators during the process. Overall, the evidence, such as a report, will be logically structured although basic in parts. Evidence may contain minor technical inaccuracies relating to engineering terminology such as mentioning 'subtractive processes' instead of 'additive processes'. B- For pass standard, learners will explain how the design of two components manufactured using traditional processes,		

	Unit 3 Distinction Learners demonstrate thorough knowledge and understanding of iterative design methodologies, processes, features, and procedures and can apply this understanding to engineering products in context. They can interpret a design brief to generate complex design ideas and will deploy a range of skills and selected techniques to develop modified products in context and with justification. They demonstrate comprehensive research and analysis skills in order to generate a product design specification that fully and effectively meets the requirements of the brief. They present justified recommendations and proposals relevant to familiar and unfamiliar situations, with consideration of design sustainability and safety issues. Learners are able to select appropriate techniques and processes to design ideas and will justify applications in arriving at creative, feasible and optimised solutions. Learners will make robust, evaluative judgements in relation to their design proposal and be able to provide detailed technical justifications in the validation of their design solution	such as machining and casting, could be improved and adapted using additive process. Suitable components include automotive and aerospace brackets and automotive valves. For example, learners will explain that the additive process reduces the amount of waste material compared to the traditional machining process. Learners will also explain what finishing processes are required on the two components if they were manufactured using additive processes. For example, hot isostatic processing may be used to reduce internal porosity and voids in components, which would improve the in-service performance of the component in safety-critical aerospace applications. Overall, the evidence, such as a report, will be logically structured although basic in parts. Evidence may contain minor technical inaccuracies relating to engineering terminology, such as mentioning 'sodium chloride' instead of 'sodium hydroxide'. C- For pass standard, learners will consider the design of a component that will be manufactured using the available AM process and include a hollow section and/or support. For example, learners should take account of the machines swept volume and that support would be needed, such as the wings of a model aeroplane. Suitable components include 3D jewellery, a scale model car, a scale model aeroplane, a scale architectural model, a child's model figurine and scale models of larger components or products are also acceptable. Learners will use AM and finishing processes to create the component or product and will check the accuracy of critical dimensional against the design. Finishing processes will include the appropriate removal of supports. The final artefact may have some dimensional errors, for example a model may be

		distorted due to the heat generated during manufacture. Overall, learners' evidence, such as a logbook, will record the activities they have completed, along with the results. For example, learners will show all design iterations, modifications to size, material, suggested ideas and rejected ideas, and the reasons why each decision was taken. Unit 45 Distinction A, B, C A-For distinction standard, learners will provide a balanced justification of at least two AM processes. For example, the evidence may cover why some prototype component manufacturers choose binder jetting for prototype manufacture instead of Fused Deposition Modelling (FDM), because binder jetting enables the manufacture of prototypes using different materials, such as steels, polymers, and glass, while the latter process is limited to polymers. Therefore, it can better meet customer needs through using a range of materials. Also, binder jetting requires little support during manufacture due to the binder, while FDM often requires structural support, which means that it requires more post-processing. Learners will also cover the accuracy and surface finish capabilities of the processes and will justify the sustainability of the process and the safe working practices applied. B-For distinction standard, learners will provide a balanced evaluation of the design of at least two components that could be adapted and improved if they were manufactured using additive processes. For example, learners could suggest that the machines are calibrated to produce accurate results and recalibrating or refining the design to accommodate

		improvements. Learners will justify how the components would be finished so that they meet the design requirements. For example, a component manufactured by wire deposition processes could be milled and polished following manufacture to ensure that critical dimensions and surface finish requirements are met. Overall, the evidence should be easy to read and understand by a third party who may or may not be an engineer. It will be structured and presented in a logical way and will use the correct technical engineering terms. Also, it will show all design suggestions and modifications, for example component form, material choice, and suggested and rejected ideas, including the reasons why. C- For distinction standard, learners will optimise the design and manufacture of a component or product, including a hollow section and/or support using additive and finishing processes. An optimised component will be one that is designed and manufactured safely, effectively, and efficiently. Efficiency mainly applies to the manufacturing process, for example learners will have set the machine parameters, such as layer height, so that the manufacturing time is reasonable while ensuring dimensional tolerances and surface finish are within the machine's capabilities. Overall, the evidence should be presented clearly and in a way that would be understood by a third party who may or may not be an engineer.