ENGINEERING

Year 9

What are the aims and intentions of this curriculum?

The Pearson BTEC Level 1/Level 2 Tech Award in Engineering is for learners who want to acquire technical knowledge and technical skills through vocational contexts by studying mechanical, electrical/electronic and engineering design as part of their Key Stage 4 learning. The qualification recognises the value of learning skills, knowledge and vocational attributes to complement GCSEs. The qualification will broaden the learners experience and understanding of the varied progression options available to them. The Award gives learners the opportunity to develop sector-specific knowledge and skills in a practical learning environment.

Term	Topics	Knowledge and key terms	Skills developed	Assessment
Summer 2	**Accident and emergency procedures and workplace roles and responsibilities.** ***Objectives:*** Define the terms safety and hazards. To develop the ability to recognize threats to personal safety in a range of contexts and to consider how these may be dealt with. Identify at least 4 types of hazards that may be found in the workplace. Discuss the procedures to follow regarding workplace hazards and safety. Understand what a risk assessment is and why they are used. Review other peoples risk assessments. Create our own risk assessments	**Learning Aim:** **Understand safe and effective working procedures in an engineering workplace**. **Key words** **Safety** – the condition of being safe from undergoing or causing hurt, injury, or loss. **Hazard** – a source of danger. **Emergency-** a serious, unexpected, and often dangerous situation requiring immediate action. **Accident-** an unfortunate incident that happens unexpectedly and unintentionally, typically resulting in damage or injury. **Emergency Action Plan** – must be in writing, kept at the workplace, and available for employees to review. The purpose of an EAP is to facilitate and organize what actions should take place among employees and employers during an emergency at work. **Personal safety**- is “an individual's ability to go about their everyday life free from the threat or fear of psychological, emotional or physical harm from others.”	***Know how to identify and control hazards in the workplace***. **Within the workplace:** methods to identify hazards e.g. statements, analysis of significant risks, prediction of results or outcomes of those risks, use of accident data, careful consideration of work methods. **Working environment:** consideration of the workplace and its potential for harm e.g. confined spaces, working over water or at heights, electrical hazards, chemicals, noise. **Hazards which become risks**: identification of trivial or significant risk; potential to cause harm; choosing appropriate control measures; electrical safety e.g. identify and control hazards, cause of injury, effects of electricity on the body, circuit overloading; mechanical safety e.g. identify and control hazards, cause of injury, rotating equipment, sharp edges; safety devices e.g. fuses, guards, fail safe, sensors. **Identifying and explaining Legislation and Regulations**: Able to explain the consequences of management not abiding by legislation and regulations and carrying out their roles and responsibilities in a given health and safety	Completion and grading of assignment booklet and homework task. Participation in class discussions. Questioning and answering. Grading of presentation using rubric. Peer assessment using rubric. Grading of written activities. Completion and grading of project.

	for specific practical task. List at least eight types of emergencies that can occur in a workplace. Explain what to do in at least four kinds of emergencies**.** Identify important information employers should provide about how to respond to workplace emergencies. Explain and evaluate the importance of an Emergency Action Plan (EAP) Explain legal legislation and regulations regarding health and safety in the workplace. Explain the importance of employees and employers adhering to correct legislation, policy and procedures in an engineering workplace. Design and make an original safety sign that will be suitable for an Engineering workshop. Select and use appropriate tools, equipment and components in the marking out of their safety signs. Students can construct their safety signs using given materials, tools and equipment.	A **risk assessment** is a systematic method of looking at work activities, considering what could go wrong, and deciding on suitable control measures. **Risk-** a situation involving exposure to danger. **A safety sign**- 'information or instruction about health and safety at work on a signboard, a colour, an illuminated sign or acoustic signal, a verbal communication or hand signal. **Safety measures**-activities and precautions taken to improve safety. **Occupational and Safety Health Administration** – "OSHA" provides information, trains workers/employers, and assists workers/employers on workplace health and safety conditions. **Occupational Safety and Health Act** – passed in 1970 to govern workplace health and safety in the private sector. **Legislation-** a law or set of laws suggested by a government and made official by a parliament. **Regulations-** a rule or directive made and maintained by an authority. **Employee's Rights** – laws, regulations, policies, and procedures in place to protect employees	situation. ***Be able to carry out a risk assessment and identify control measures***. **Risk assessments:** items/area to be assessed e.g. machine operation, work area; five steps (principal hazards, who is likely to be injured/harmed, evaluate the risks and decide on adequacy of precautions, recording findings, review assessment) **Use of control measures:** e.g. remove need (design out), use of recognized procedures, substances control, guarding, lifting assessments and manual handling assessments, regular inspection, use of Personal Protective Equipment (PPE), training of personnel, other personal procedures for health, safety and welfare. ***Understand the methods used when reporting and recording accidents and incidents.*** **Principles:** why employers keep records of serious accidents, incidents and emergencies; responsibilities of competent persons; cost of accidents e.g. direct, indirect, human consequences; trends e.g. major causes, fatal and serious injury, methods of classification, statistics. **Recording and reporting procedures:** regulations on accident recording and reporting e.g. Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 1995, accident book, company procedures; procedures to deal with near misses or dangerous occurrences	

Autumn 1	**Preparing for and carrying out an engineering activity.** ***Objectives:*** Recognize the importance of safety when using workshop tools, equipment, machines and components; and Recognize potential hazards in products, activities and environments. Demonstrate an understanding of risk assessment: – what is the potential hazard? – who could be harmed and how? – what can be done to prevent it from happening? Identify the tools and equipment required to produce a reliable, functioning technological product. Design and make an original product from a given scenario to solve an Engineering problem, taking in consideration the design process.	**Learning Aim:** **Identify health and safety signs used in the workshop. Identify safe procedures and practice.** **Key words** **Tools-** a device or implement, especially one held in the hand, used to carry out a particular function. **Equipment-** the necessary items for a particular purpose. **Design-** a plan or drawing produced to show the look and function or workings of a building, garment, or other object before it is made. The **Design Process** is an approach for breaking down a large project into manageable chunks. This process can be used to define the steps needed to tackle a project, and remember to hold to all of the ideas and sketches throughout the process.	Complying with essential health and safety requirements. Carry out standard risk assessment on workshop before carrying out practical task. Learners will become expert in using the design process to design and manufacture their own products. They will be able to demonstrate the safe use of all tools needed to manufacture their products. Use different finishing techniques to make final product successful and attracted to customers.	Feedback from class discussion. Grading of worksheets. Questioning and answering. Peer assessment using rubric. Grading of written activities. Completion and grading of project.

Autumn 2	**Introduction to Technical drawing.** ***Objectives*** **At the successful completion of this unit students should:** Have the basic knowledge of Technical Drawing. This knowledge includes the definition, instruments and types of lines commonly used in Technical Drawing. Have the basic knowledge of how to border, set up a Title Block and do the necessary lettering correctly on a drawing paper. Be able to bisect a line correctly and perform other basic operations on lines such as: dividing a line into equal parts and ratios. Develop a comprehensive understanding of the term 'angles'. This includes classifying and constructing angles. Be able to accurately identify types of triangle based upon their classifications. Be able to construct triangles based on different information given, for example all three sides or 2 sides and one angle.	**Learning Aim:** **To help students to develop a general understanding of the basics of Technical Drawing and its relevance in society.** **2. To help students to develop a general understanding of the basic concepts in Technical Drawing and how to apply them in future lessons.** **Key words** Technical Drawing, tee square, set squares, protractor, French curves, flexi curves, continuous thick and thin lines, chain lines, dimension lines, title block, bordering and guidelines. **Technical drawing**- Technical drawing, also known as drafting or draughting, is the act and discipline of composing plans that visually communicate how something functions or has to be constructed. **Lettering-** Used to give dimensions and other important information needed to fully describe an item. **Guidelines**- Lightly drawn lines used for lettering. **Object Lines**- Thick dark lines that outlines an object **Hidden detail Lines**- Short dash lines use to show non visible surfaces. Usually shows as medium thickness. **Construction line** – very light and thin line use to construct layout work. **Dimension line** – Thin and dark lines use to show the size (span) of an object with a numeric value. **Centre line** – Long and short dash lines. Usually indicates centre of holes, circles and arcs. Line is thin and dark.	Students will develop the art to precision as it is of the utmost importance in all technical drawing. Drafts and product designs in all fields of engineering are expected to be scaled, labeled and arranged exactly as the final product would be. The proper use of the Technical drawing tools and equipment will ensure students master such skills. Students will acquire the skill of Lettering as it is an important part of engineering drawing. It gives information regarding size, and instructions, in the form of notes and dimension. Students will know the importance of the different lines used in Technical drawing as lines represent everything in these drawings. From the depth and intensity of the design that is going to be represented, to the necessary and required details, the section that should be in focus, etc. Everything is represented through the intensity of lines in technical drawings and it is very essential to draw them with all the care and with the required purpose. Students will acquire all the skills required to use Technical drawing instruments to measure and layout drawings, or to improve the consistency and speed of creation of standard drawing elements. Students will acquire the skills needed to construct different angles which will assist them with the trigonometry unit in Mathematics.	Feedback from class discussion Grading of worksheet on the types of drawing instruments and lines. Grading of research on CAD and Geometry. Marking of students bordered drawing paper. Student feedback from quiz. Marking and grading of students' class work. Assessment of students' input in the demonstrations. Test 1: constructing lines and angles Test 2. constructing triangles and quadrilaterals.

		Drawing Sheet- Drawing sheet is a white paper on which an object is drawn which is available in various sizes. **Drawing Board-** Drawing board is generally made of soft wood and it is in rectangular shape. It is used to support drawing sheet, so, the size of board is made according the size of the drawing sheet. **T-Square-** T square is used to draw horizontal and vertical lines on drawing sheet**.** **Compass-** Compass is used to draw an arc or circle with known dimensions on engineering drawing. **Set Squares-** Set squares are used to draw lines with an angle between them. In most of the structures, 30, 45, 60 and 90-degree lines are most common. So, set squares make the work easier for this type of drawings. **Protractor-**Protractor is used to draw and measure the angles of lines in the drawing. **French Curves-**French curves are made of plastic and they are in irregular shapes. **Perpendicular-** at an angle of 90° to a given line, plane, or surface or to the ground. **"Bisect"** means to divide into two equal parts. You can bisect lines, angles, and more. **Ratio-** the quantitative relation between two amounts showing the number of times one value contains or is contained within the other.		

Spring 1	**Technical drawing techniques. (Isometric and Orthographic)** **Objectives:** After this lesson, students will be able to: Explain isometric drawing and its principles. Demonstrate an understanding of how to draw isometrically. Explain the differences between isometric drawing and other three dimensional drawing. Use isometric axis to draw given objects. Explain orthographic projection. Explain the principles of both first and third angle projections. Distinguish between first and third angle projections. Draw objects in first and third angle projections. Learnt how to annotate and dimension a drawing. Learnt how to produce sections and parts drawings.	**Learning Aim:** **To be able to sample a range of technical drawing techniques.** **Key words** **Isometric drawing**, method of graphic representation of three-dimensional objects, used by engineers, technical illustrators, and architects. **3D-** three-dimensional. **Oblique drawing:** a projective drawing of which the frontal lines are given in true proportions and relations and all others at suitable angles other than 90 degrees without regard to the rules of linear perspective. **Projections-** A 3D projection or graphical projection maps points in three-dimensions onto a two-dimensional plane. **Orthographic projection**- a method of projection in which an object is depicted using parallel lines to project its outline on to a plane. Third angle projection. First angle projection. **Dimensioning** is the process of specifying part' s information by using of lines, number, symbols and notes.	The students will develop the skills of constructing real life objects in 3D. These are very important skills for engineers because they can easily and unambiguously read off the various dimensions from the drawing and easily communicate between designer, client and manufacturer. Learners will be able to differentiate between 2D and 3D drawings. Learners will be able to explain the differences between isometric drawing and other three dimensional drawing. Learners will be able to draw objects in first and third angle projections and annotate and dimension drawings.	Feedback from class discussion. Grading of worksheets. Questioning and answering. Peer assessment using rubric. Grading of written activities.

Spring 2	**CAD –Computer Aided Design.** **The students will be able to:** Open and close a technical program successfully. Navigate software. Identify key areas of the CAD interface. Identify key vocabulary terms related to the CAD program. Perform basic mouse and keyboard functions used with the CAD program. Create orthographic and isometric drawings on different scales. Modify commands: copy, move, paste, offset, fillet. Print a drawing on the classroom printer.	**Learning Aim:** **To be able use CAD to achieve higher levels of accuracy, repeatability and efficiency when producing engineering drawings.** **Computer Aided Drawing (CAD):** the use of precision-drawing software programs to accelerate the design process by making it easier to create and modify draft designs. **Plan:** a drawing or diagram, particularly one illustrating the layout and constituent components to design a building, made by projection on a horizontal plane. **Design:** a plan or drawing that demonstrates the form and function of a building, garment, or other object prior to its being created. **Fillet:** a command in CAD software allowing you to create a rounded inside or outside curved corner. **Grid**: a pattern of dots or lines within the work area of the software that can be used to aid in drawing. **Offset:** a command that creates a copy of an entity (line, circle, etc.) that is a specified parallel distance away from the current object(s) selected. **Title block:** an area of a drawing sheet that contains information about the actual drawing, including project name, author, scale, drawing number. **Trim:** a command used to “trim” off excess length on an object or entity, to end exactly at the end or intersection of another entity.	The learner completing these lessons will develop skills and competencies with frequently used commands and terminology related to two-dimensional and three-Dimensional drawing. The students will be able to use computer and CAD software to model different engineering components. Learners will be able to use CAD to design and develop products to be used by consumers. Learners will be able to visualize their final designs of the product that is to be made, it subassemblies and the constituent parts. Learners will use CAD to Improve the quality of their design: With the CAD software students will use large number of tools that will help in carrying out thorough engineering analysis of the proposed design.	Feedback from class discussion. Grading of worksheets. Questioning and answering. Peer assessment using rubric. Grading of written activities. Student feedback from quiz. Marking and grading of students’ class work.

Summer 1	**Products, Sectors and Organizations.** **Objectives:** Explain the term engineering? Understanding the need for engineers. Understanding the engineering design and make process. Develop and demonstrate the safe application of technical and practical knowledge. Identify and explain the different engineering sectors. Identify different engineered products. Exploring and analysing different engineering organisations and their functions. Understanding and explaining Engineering job roles and career progressions.	**Transition to Year 10** **Learning Aim**: **Understand engineering sectors, products and organizations, and how they interrelate.** **Explore engineering skills through the design process.** **Engineering** is the branch of science and technology concerned with the design, building, and use of engines, machines, and structures. **Electrical and electronic engineering –** engineering that specializes on electrical and electronic equipment, interfaces and communications. Electrical engineering tends to focus on larger scale electrical equipment and power, whilst electronic engineering is more focused on smaller electronic devices and electronic circuits. **Chemical engineering –** this engineering field is concerned with how biological and chemical processes can be used to develop new materials and substances. **Mechanical engineer:** These engineers focus on the design and development of powered machines and engines. This could include automotive engineers, who can be found anywhere from your local garage to leading car manufacturers. **Civil engineer**: These professionals keep our towns and cities running smoothly, engineering the systems and frameworks that power our everyday lives, including roads, bridges, water supplies and buildings.	Students will know the fundamentals and skills needed to work in each sector of engineering. Engineering is rife with situations that require diligent problem-solving. Learners will develop problem solving skills necessary to solve existing engineering problems. They will learn have the necessary skills to be able to approach every task and problem with a cool, unemotional, analytical mind. Use a logical and creative approach to solve complex engineering problems. Learners will be able to research and analyze how different sectors are interrelated to design and manufacture different engineering products and how each sector applies themselves to make the design process a success. Learners will have a better understanding of different engineering organizations relating to their sizes, products and manufacturing.	Feedback from class discussion. Grading of worksheets. Questioning and answering. Peer assessment using rubric. Grading of written activities.

		Aerospace engineering is the primary field of engineering concerned with the development of aircraft and spacecraft **Interrelate-** relate or connect to one another. **Interconnections**- a mutual connection between two or more things. An **applications engineer** is an individual that designs, develops and tests software applications. **Hazard** – a source of danger. A **risk assessment** is a systematic method of looking at work activities, considering what could go wrong, and deciding on suitable control measures. **Risk-** a situation involving exposure to danger. **A skilled** worker is any worker who has special skill, training, knowledge, and (usually acquired) ability in their work.		