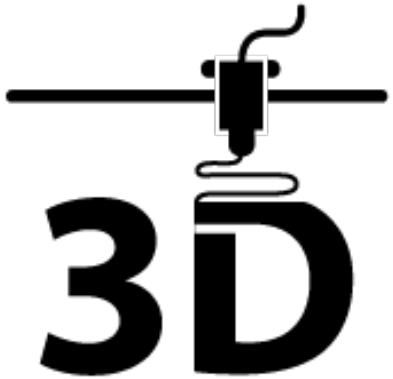
Level 3 - Unit 45 – ADDITIVE MANUFACTURING PROCESSES

BTEC

Knowledge Organiser



3D Printing

Learners cover the principles and practical methods used in additive manufacturing (AM) and develop a component using additive processes.

Unit Overview

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 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.

Learning Aim A

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 assteels, 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.

Learning Aims:

A 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

C Develop a component using additive manufacturing processes safely.

Learning Aim B

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.

Learning Aim B

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.

Key Vocabulary

CAD, CAM, Datum, tolerances

Work Related Learning:

The 3d Printing used by the school is a skill which is sought after in industry, which gives students a knowledge they can directly use in employment.

Numeracy links:

Mathematics based on accuracy, using measurements.

SMSC and British Values

Understanding the importance that 3d deign and Manufacturing can have to solve critical issues in the world.