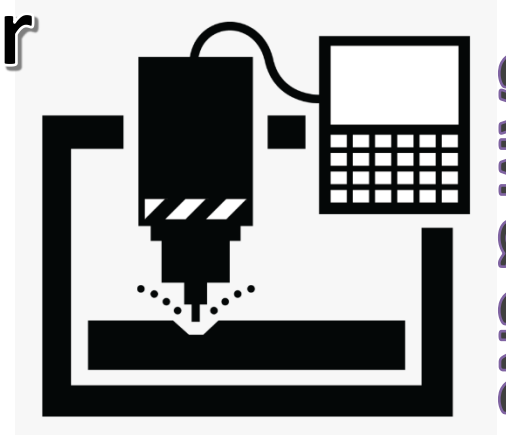
Level 3 - Unit 40 – Computer Aided Manufacturing and Planning

BTEC

Knowledge Organiser



Learners examine manufacturing-process automation and planning using computer software and technology. Learners will simulate the manufacture of a component.

Unit Overview

Computer-aided manufacturing (CAM) is used extensively to manufacture products efficiently and effectively by world-class-manufacturing organisations. CAM involves the control by software of machine tools and associated systems to produce components. These systems are used to automate and plan the manufacture of products and components, such as cars, computers and medical devices, efficiently and effectively. In this unit, you will investigate how CAM systems are used in the efficient and effective planning and manufacture of products. They are used to increase the profitability of manufacturing organisations by reducing manufacturing costs, improving quality and being more responsive to customer needs. For example, machining metal is time consuming and expensive, so a 'right first time' approach is a crucial aspect of economic manufacture. You will explore how the manufacturing process can be automated by moving materials and components efficiently between the machine tools and workstations that make up a flexible manufacturing system (FMS). You will also simulate the manufacture of a component from a given specification, using computer-aided design (CAD) software to draw it and CAM software to simulate the manufacture. As an engineer, it is important to understand the manufacturing planning systems and process and how to create products and/or components through the use of CAM systems.

Learning Aim A

learners will provide in their evidence a balanced evaluation of how two different CAM systems can benefit the manufacturing organisations, the technology used and the operation of each system. Learners should focus their evaluation on how the CAM systems are efficient and effective and how they have been optimised for their specific process or have the flexibility to manufacture several different components at the same time. For example, a company may have invested in a multi-axis machining centre to meet the versatility of their product range, producing components for the automotive industry, while a separate company may have invested in a specialist additive manufacturing process to manufacture aerospace brackets in titanium. Learners will compare the technology used in the CAM systems and operation of systems.

Learning Aims:

A Examine the benefits, technology and applications of computer-aided manufacturing systems that improve the operation

B Develop a virtual component on a computer-aided manufacturing system that simulates its manufacture

C Investigate planning documentation used to optimise the workflow and initiate manufacture in the operation.

Learning Aim B

learners will optimise the virtual manufacture of a component that has been modelled using 2D- or 3D CAD and transferred to a simulation package either offline or a machine's CAM graphical simulation system. Learners will set up the CAM system software parameters accurately to manufacture the component. For example, setting tooling lengths, offsets, and tool nose radii. The part program will be graphically simulated and edited to ensure the finished virtual component conforms to specification. For example, it may be necessary to return to the initial CAD drawing or CAM package to change the order of machining features, for example to ensure that a radii is not removed by further machining process. The process will be optimised for efficient manufacture. Optimised efficiency can be achieved by considering the correct selection of tooling, the order of tool selection, setting machine parameters correctly, such as speeds and feeds and the distance travelled by the tooling and components from initial storage to finished component

Learning Aim C

learners will optimise the manufacturing plan and schedule that will be accurate and concise for a range of order quantities. Learners may incorporate the product or component designed as part of learning aim B in the plan and schedule it with at least two other products. The manufacturing plan will incorporate estimated sales volume and the relevant resources required. For example, an automotive manufacturer will need to ensure that stock is available at the required time and rate. This may include pre-ordering proprietary components or arranging the manufacture of specialist components in-house or via sub-contractors. These factors will need to be considered in relation to the required order quantities. For example, the workflow, and stock inventories required will be different for different batch sizes. Optimisation of time and resources in the plan and schedule is fundamental to prevent waste, for example idle machines and human resources. The correct cycle times with optimised tool movement, against reduced inventories and cutting times will be used appropriately. For example, castings of automotive cylinder blocks will be ordered to meet the manufacturing cycle, these will be related to the manufacturing cells process cycle times with a minimum stock holding. The planning documentation will need to specify appropriate volumes so that the manufacturing process is efficient and effective.The schedule will reflect the requirements of a high-technology company in relation to a lower-technology company, an example of this may be the development of Critical Path Analysis to aid the material flow through the FMC and the integration of planning and scheduling software to support the manufacturing activity.

Key Vocabulary

CAD, CAM, Datum, tolerances

Work Related Learning:

The packages used by the school are industry standards, 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 good design can have to solve critical issues in the world.