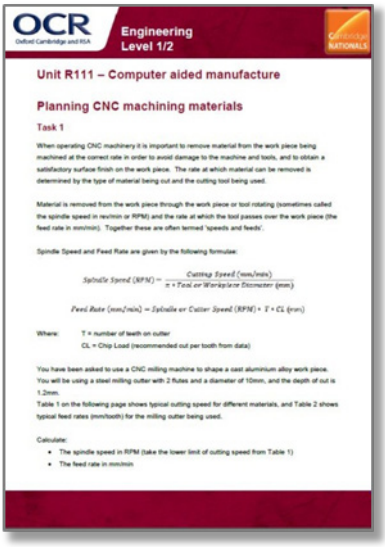
Unit R111 – Computer aided manufacture

Planning CNC machining materials

Instructions and answers for teachers

*These instructions should accompany the OCR resource **'Planning CNC machining materials'** activity which supports OCR Cambridge Nationals in Engineering.*



The Activity:

This resource comprises of 1 task.

This activity offers an opportunity for maths skills development.

Associated materials:

'Planning CNC machining materials' activity sheet

Suggested timings:

Task 1: 1 hour

Learning outcome 1 – Be able to plan the production of components on Computer Numerical Control (CNC) machines

Task 1

The purpose of this activity is for learners to investigate the significance of selecting the correct cutting speed and feed rate for different materials when undertaking machining operations.

Learners may require teacher guidance before and during the activity in order to understand and perform the required calculations of spindle speed and feed rate. They may also require a suitable introduction to the terminology and nomenclature associated with these calculations.

Learners are required to use the equations for Spindle Speed and Feed Rate below:

$$\textit{Spindle Speed (RPM)} = \frac{\textit{Cutting Speed (mm/min)}}{\pi \times \textit{Tools or Workpiece Diameter (mm)}}$$

$$\textit{Feed Rate (mm/min)} = \textit{Spindle or Cutter Speed (RPM)} \times T \times \textit{CL (mm)}$$

Where: T = number of teeth on cutter
CL = Chip Load (recommended cut per tooth from data)

Solution to the problems using the data supplied in the activity is as follows:

	Cast aluminium alloy	Mild steel
Spindle Speed (rev/min – RPM)	2387 RPM	955 RPM
Feed Rate (mm/min)	363 mm/min	97 mm/min

The solutions shows that spindle speed and tool feed rate are reduced for harder materials.

A simple spreadsheet has been developed to perform these calculations and teachers could ask learners to develop a similar spindle speed and feed rate calculator as part of the activity.

The problems and data in this activity use indicative values only and teachers may wish to introduce learners to real manufacturer's data in order to perform calculations. Teachers may also use this activity as the basis for determining spindle speed and feed rate when setting up a CNC machine.

Teachers and learners may also find other 'rule of thumb' approximate formulae for calculating spindle speed and feed rate. It should be noted that the formula and data for feed rate do not relate to that for turning (lathe) operations where the feed rate is given as feed per revolution.