

**CNC – CAM – CAD – 3D PRINTING**  
**LASER CUTTERS – VINYL CUTTERS**

This mobile revision pdf is based on detailed work found in the 'CNC' section. Tap on the green link button below to go to the complete website section



Tap the blue button to view CAD/CAM covered by this Revision PDF



# CNC – CAM – CAD – 3D PRINTING LASER CUTTERS – VINYL CUTTERS

1. CAD – COMPUTER AIDED DESIGN

2. WHAT IS CNC / CAM?

3. ADVANTAGES OF CAD AND CAM

4. MANUFACTURE OF PRINTED CIRCUIT BOARDS BY CNC/CAM MACHINES

5. 3D PRINTING

6. LASER CUTTERS

7. VINYL CUTTERS

# COMPUTER GENERATED MODELS (CAD)

The model below has been generated using CAD (Computer Aided Design) software. The furniture has been drawn individually and placed inside the computer generated room. The room can be rotated to almost every possible angle. This design can be shown to potential customers or a client and changes made according to his/her likes and dislikes. This saves time and money as the model can be altered using the software which is far more efficient than making a real model using materials.

**Tap the image** for more information and examples



V.Ryan © www.technologystudent.com 2019

Tap the blue button for the next CAD/CAM page.



Tap the red button to return to the Contents page



# COMPUTER GENERATED MODELS (CAD)

V.Ryan © www.technologystudent.com 2019

CAD plays an important role in the design and manufacturing process.

Designing usually starts with sketches, simple models and CAD AND then leads to the manufacture of the product, as seen below.

**Tap the image for more information**

## SKETCHES AND CAD

This chair folds into a cuboid shape, it can be placed in the back of a car for transport, as it is a regular shape. It has two comfortable cushions and the seating positioned has been determined to meet ergonomic demands.



## MODEL

The card and styrofoam model shown below, helped to determine the proportions of the chair and also the folding mechanism. Without a scaled model, testing the folding mechanism would have been difficult.



## MANUFACTURE

The final manufactured chair. A mixture of ash for the back rest, legs and arm-rests. Plywood was used for the main seat frame.

Two brass rotating joints for the back rest and four aluminium rotating joints for the legs (all manufactured on a centre lathe).



V.Ryan © www.technologystudent.com 2019

Tap the red button to return to the Contents page



# WHAT DOES CNC and CAM MEAN?

V.Ryan © www.technologystudent.com 2019

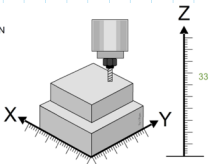
CNC means 'Computer Numerical Control'.  
CAM means 'Computer Aided Design'.

This means a computer converts the design produced by Computer Aided Design software (CAD), into numbers. The numbers can be considered to be the coordinates of a graph and they control the movement of the cutter. In this way the computer controls the cutting and shaping of the material.

**Tap the image** for more detail

COORDINATES SHOWN

X, Y, Z  
(07, 21, 33)



Tap the blue button for the next  
CAD/CAM page.



Tap the red button to return to the  
Contents page

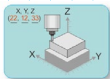
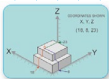


# FROM CAD TO MANUFACTURE ON A CNC/CAM MACHINE

V.Ryan © www.technologystudent.com 2019

CAD software such as AutoCAD or even Sketchup, allows the designer to create a 3D model. The model is then converted into coordinates, ready for manufacture on a CNC Router or a 3D printer. This type of machine allows the manufacture of 3D products/items. 2D products / items are often manufactured by a laser cutter.

**Tap the image** for more detail.



**CNC ROUTER**



V.Ryan © www.technologystudent.com 2019

Tap the red button to return to the  
Contents page



# ADVANTAGES CAD

V.Ryan © www.technologystudent.com 2019

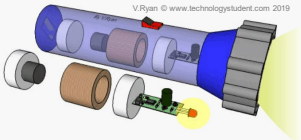
CAD designs can be changed / updated continuously, with ease, unlike hand drawn designs.

3D CAD designs can be shown to clients, from every possible angle, helping the design process.

CAD saves time and money as the model can be altered using the software, which is far more efficient than making a real model using materials.

A product can often be simulated by CAD, on the computer screen. before manufacture.

**Tap the image** for more detail.



V.Ryan © www.technologystudent.com 2019

V.Ryan © www.technologystudent.com 2019

Tap the blue button for the next CAD/CAM page.

Tap the red button to return to the Contents page



# ADVANTAGES CAM

V.Ryan © www.technologystudent.com 2019

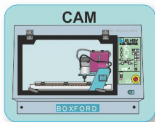
CNC / CAM machines can be used continuously 24 hours a day, 365 days a year and only need to be switched off for occasional maintenance.

A design can then be manufactured hundreds or even thousands of times. Each manufactured product will be exactly the same.

One person can supervise many CNC machines.

Less skilled/trained people can operate CNCs / CAM machines.

**Tap the image for more detail.**



V.Ryan © www.technologystudent.com 2019

Tap the red button to return to the Contents page





# MANUFACTURE OF PRINTED CIRCUIT BOARDS (PCBs) CNC MACHINES

PCBs are normally etched using 'clear etchant' or 'ferric chloride'. These are dangerous chemicals and if contact is made with the skin or especially the eyes, the medical consequences can be serious. Many people, especially in schools, prefer to use software such as Real PCB, to export PCB designs, so that they can be cut to shape on a CNC / CAM router.

**Tap the image** for more detail.



V.Ryan © www.technologystudent.com 2019

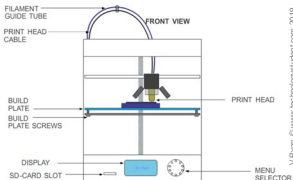
Tap the red button to return to the  
Contents page



# FILAMENT SPOOL 3D PRINTERS

3D printing is already important as an industrial process, in the production of some tools, textiles, toys, jewellery and a range of components. The technology also has been used in the medical world, in the manufacture of custom made prosthetic limbs and hearing aids. It even has a practical application in the world of dentistry. Research has been taking place for several years on 'bioprinters'. These are complex 3D printers, capable of printing bio-structures, used in surgery.

**Tap the image for more detail.**



V.Ryan © www.technologystudent.com 2019

V.Ryan © www.technologystudent.com 2019

Tap the blue button for the next  
CAD/CAM page.



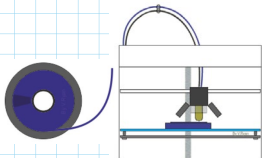
Tap the red button to return to the  
Contents page



## HOW FILAMENT SPOOL 3D PRINTERS WORK

3D printers construct a 'model' by building up layer upon layer of PLA, Nylon or ABS, fed from spool, usually at the back of the printer. Each layer is a fraction of a millimetre and building even a small model can take sometime. The PLA / ABS is purchased in the form of filaments on open spools. Filaments tend to be 2.85mm diameter (known as 3mm filament), rolled on to a spool. The spool fits on a roller, normally on the back of the 3D printer.

**Tap the image for more detail.**



V.Ryan © www.technologystudent.com 2019

Tap the blue button for the next  
CAD/CAM page.



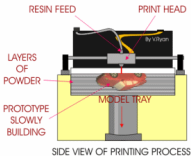
Tap the red button to return to the  
Contents page



# RAPID PROTOTYPING - THE 3D PRINTER

Industrial 3D printers use a powder and a resin / laser to build a layer at a time. A layer of powder is automatically deposited in the model tray. The print head then applies resin in the shape of the model. The layer dries solid almost immediately. The model tray then moves down the distance of a layer and another layer of powder is deposited in position, in the model tray. This sequence occurs one layer at a time until the model is complete.

**Tap the image for more detail.**



V.Ryan © www.technologystudent.com 2019

Tap the blue button for the next CAD/CAM page.



Tap the red button to return to the Contents page



**LINKS TO DETAILED  
PAGES REGARDING 3D  
PRINTING**



V.Ryan © www.technologystudent.com 2019

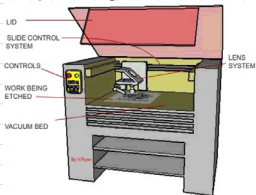
Tap the red button to return to the  
Contents page



# LASER CUTTING / ETCHING MACHINES

Laser cutting / etching machines are quite simple in the way they work. The lens system that controls the position of the laser, is moved by a motorised slide control system. This allows movement in any direction. The control system moves according to the software being used by the machine. The diagram shows the LID open - however, the laser will not operate unless the lid is closed, a safety feature.

**Tap the image for more detail.**



V.Ryan © www.technologystudent.com 2019

Tap the blue button for the next  
CAD/CAM page.



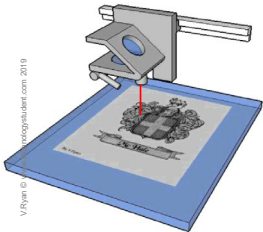
Tap the red button to return to the  
Contents page



## HOW A LASER CUTTER WORKS

The laser is focused through a lens system. The position of the lens system is controlled by motors. The laser either cuts through the material or etches its surface. The lens system is controlled by software and follows the design being cut / etched.

**Tap the image** for more detail.



V.Ryan © www.technologystudent.com 2019

V.Ryan © www.technologystudent.com 2019

Tap the blue button for the next  
CAD/CAM page.



Tap the red button to return to the  
Contents page



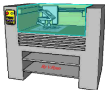
# LASER CUTTING / ETCHING MACHINES FROM DESIGN TO MANUFACTURE

**Tap the image** for more detail regarding the stages involved in design to laser cutting / etching.

DESIGN PRODUCED USING VECTOR / IMAGE SOFTWARE



DESIGN PRINTED TO LASER CUTTER USING FILE AND PRINT MENUS.  
MACHINE CUTS / ETCHES DESIGN ON MATERIAL



FINAL MANUFACTURED PRODUCT



V.Ryan © www.technologystudent.com 2019

Tap the red button to return to the Contents page



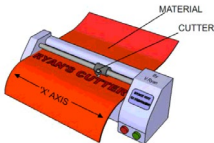


# VINYL CUTTERS

V.Ryan © www.technologystudent.com 2019

These are used for cutting out adhesive backed lettering for signs and logos and other shapes (the material is often called 'sticky backed vinyl'). However, larger versions can be used to cut out nets / developments from a range of card. The small hardened steel cutter is held firmly in a tool holder. The tool holder moves up and down a slide, following the design. The paper/adhesive laminate is fed into the machine automatically. As the tool holder moves the cutting tool is pressed into the material, cutting the desired shape

**Tap the image** for more detail.



V.Ryan © www.technologystudent.com 2019

Tap the blue button for the next  
CAD/CAM page.



Tap the red button to return to the  
Contents page



# VINYL CUTTERS

Tap the **LINK BUTTONS** for more information and exercises on vinyl cutters.



V.Ryan © www.technologystudent.com 2019

Tap the red button to return to the Contents page

