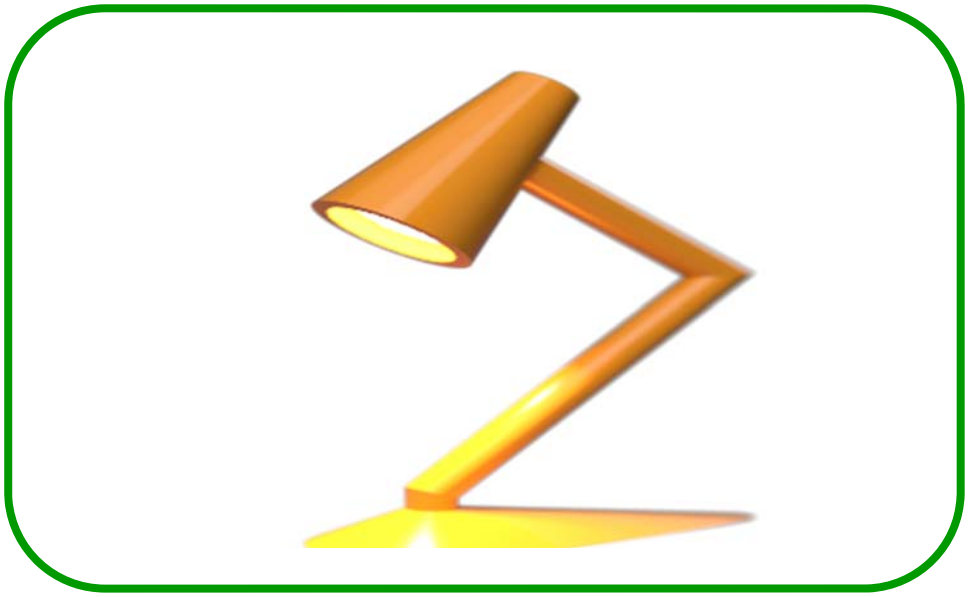
DENFORD®

CAD/CAM Projects

USB Lamp Project



TEACHER SUPPORT GUIDE

Denford: USB Lamp Project - Denford CNC Router/Vacuum Forming Machine

Teacher Support Guide

Students are tasked with designing and making a USB powered LED Lamp. The Lamp will be manufactured by vacuum forming, the mould for which will be designed in Fusion 360 and machined using high density modelling foam on the Denford CNC Router. The design must be made in two halves and glued together when finished.

Project Timeline Summary

It is anticipated that learners will spend a total of approximately 8 hours in producing the work for this project (each session being around 1 hour). Learners will be expected to have had previous experience in using Autodesk Fusion 360.

Throughout this project, learners will need to apply problem-solving and designing skills, developed in earlier years, in order to achieve a successful outcome.

Session	Focus	General Content
1	Product Research & Design	Understanding the context of the product. / secondary research of products / start to generate an idea.
2	Designing & Developing a Final Solution	Finish the sketch idea to satisfy the requirements of the problem / sketch final design in 3D form, both assembled and exploded.
3	CAD Design	Using Fusion 360 generate a CAD version of the design. The final design will need to be split in half and attached to a flat body to create a vacuum form mould.
4	Finish CAD Design / CNC Post Processing	Using Fusion 360, complete and CAD work, then export STL's for manufacture.
5	QuickCAM Pro Post Processing	Import files into QuickCAM Pro and set up files for importing into VR Milling.
6	CNC Manufacture & Vacuum Forming	Using VR Milling, and the Denford Router, machine out the mould, prepare the mould for forming and vacuum-form the part.
7 & 8	Assembly & Finishing	Trim the product, prepare the electronic circuit and assemble the final product.

Project Delivery Session Detail

Session	Focus	Session Content
1	Product Research & Design	Ask students to read through the design problem, then working individually to carry out research on the internet and make rough sketches of products they like the look of. Ask them to annotate any design features they particularly like. Now get students to take a look at the design considerations page and talk them through the constraints such as fitting the circuit board and the overall size of the product and how the product will be manufactured. Explain to the students that we will not be going through the traditional designing process, and the development of the design will happen within the designing of the CAD model. Ask students to draw a concept sketch of a lamp they would like to bring forward using inspiration from their mood board.
2	Designing and Developing a Final Solution	Students will need to finish their concept idea if they have not already done so, then move straight into the layout of the mould and sketch out how their design will look split in half onto the sheet of foam.

Session	Focus	Session Content
3	CAD Design	Using Fusion 360, follow the CAD support booklet to draw their own lamp design. The process will start by students drawing a complete sketch, 150mm x 110mm x 22.5mm, This will represent the maximum size for one half of the design. Then, through a series of drawing operations, create the overall shape of the lamp. Students will then add a circuit assembly to the lamp to check for fit, and edit their design as necessary. Finally, students will split the block into two halves and move the bodies to create a vacuum form mould ready for manufacture. Students can use the CAD support booklet to support them in self-guided learning.
4	Finish CAD Design / CNC Post Processing	Students will need to use this session to firstly complete any outstanding CAD work and secondly export their file for use in QuickCAM Pro. This will need to be in STL format. Follow the CAD support booklet to ensure the file is ready and exported correctly.
5	QuickCAM PRO Post Processing	Using the CAD Support Booklet, Students will need to import their drawing into QuickCAM Pro and set-up machining programmes for the mould. Within QuickCAM, it will be necessary for students to set-up a roughing and finishing pass, to ensure a good quality finish.

Session	Focus	Session Content
6	CNC Manufacture & Vacuum Forming	The Teacher/Technician will need to set up the router to hold the pre-cut sheet of foam. Import the **.fnc** file into VR CNC Milling V5, and machine using the long series cutter. Also Offsets for this project will need to be pre-programmed, all students can then use this ***– This will be covered in training; however, you can also check your Denford VR CNC Milling V5 Training guide for guidance on how to do this.*** Once the mould is machined, students will need to prepare the mould for vacuum forming, by lightly sanding any imperfections and coating it with the mould release agent. Students will then vacuum form their designs, using a HIPS vacuum forming sheet.
7 & 8	Assembly & Finishing	Once formed, students will then need to remove the mould as best they can. Do not worry if you cannot get all of the mould out. Now using the trimmer, cut around each profile so the students have two separate halves. Students will now need to assemble the USB LED circuit. Place the circuit into the shade of one of the halves of the lamp and trim the shade where the switch and LED are and glue in the circuit. Finally, glue the two halves together and keep them held in place with masking tape, until set and dry.

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