LEARNING OUTCOMES

The learner will:

1. Produce components by rapid prototyping techniques.

ASSESSMENT CRITERIA

The learner can:

1.1. Work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines.

1.2. Prepare the system and data for operation by carrying out all of the following:
   • check that all the equipment is in a safe and usable working condition (such as undamaged, safety devices in place and operational)
obtain sufficient quantities of all required materials and checking use by dates
• obtain all the necessary data, documentation and specifications for the components to be produced
• download the correct build files to produce the components
• check that data files are suitable for the application
• apply safe working practices and procedures at all times.

1.3. Select the type of rapid prototyping machine to be used.

1.4. Identify material specification before they start.

1.5. Check material availability.

1.6. Load/input the program file to the machine controller, and check the program for errors using the approved procedures.

1.7. Check that all safety mechanisms are in place, and that the equipment is set correctly for the required operations.

1.8. Set up the rapid prototyping equipment, to include carrying out all of the following:
• powering up the equipment and activating the appropriate software
• importing files from system
• loading materials
• checking/setting equipment operating parameters.

1.9. Produce the required components, using appropriate manufacturing methods and techniques.

1.10. Produce components using one of the following types of rapid prototyping equipment:
• stereo lithography apparatus (SLA)
• fused deposition modelling (FDM)
• selective laser sintering (SLS)
• direct metal laser sintering (DMLS)
• selective laser melting (SLM)
• 3D printing (thermojet)
• laminated object manufacturing (LOM)
• digital light process (DLP)
1.11. Produce components made from one of the following materials:
- photo-polymer resin
- plastics
- wax
- metal
- laminated paper
- polyurethane.

1.12. Unload the components from the rapid prototyping equipment, to include carrying out all of the following:
- removing the part from remaining raw material
- removing the part from supports (where applicable)
- pre-cleaning
- infiltrate (when required)
- packing to avoid damage
- storing
- complete all relevant documentation (such as material batch number, CAD file name, date of manufacture, operator’s name, quality report).

1.13. Produce components which comply with all the following quality and accuracy requirements:
- correctly formed
- checked against model specification
- free from manufacturing defects
- satisfactory visual appearance/finish.

1.14. Deal promptly and effectively with problems within their control, and seek help and guidance from the relevant people if they have problems that they cannot resolve.

1.15. Shut down the equipment to a safe condition on completion of the rapid prototyping activities.

2. Know how to produce components by rapid prototyping techniques.

2.1. Describe the safe working practices and procedures to be observed when setting and operating rapid prototyping equipment (such as care when working with laser beams; machine guards; ventilation and fume extraction; machine safety devices).
| 2.2. | Explain how to start and stop the machine in normal and emergency situations, and how to close the machine down on completion of activities. |
| 2.3. | Describe the hazards associated with operating rapid prototyping machines (such as dangers from laser beams; live electrical components; materials; fumes/gases), and how they can be minimised. |
| 2.4. | Describe the importance of wearing appropriate protective clothing and equipment (PPE), and keeping the work area safe and tidy. |
| 2.5. | Describe the importance of ensuring that the machine is isolated from the power supply before working with the equipment. |
| 2.6. | Describe the methods and procedures used to minimise the chances of infecting a computer with a virus. |
| 2.7. | Describe the implications if the computer they are using does become infected with a virus and who to contact if it does occur. |
| 2.8. | Describe the basic principles of rapid prototyping relevant to the machine being used. |
| 2.9. | Describe the benefits and limitations of the different types of rapid prototyping equipment. |
| 2.10. | Describe the rapid prototyping techniques used, and how to differentiate between the different processes (including the advantages and disadvantages). |
| 2.11. | Describe the finishing techniques that are required, and how they are applied to the different rapid prototyping processes. |
| 2.12. | Explain how to use and extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS or ISO standards) in relation to work undertaken. |
| 2.13. | Explain how to interpret first and third angle drawings, imperial and metric systems of
measurement, workpiece reference points and system of tolerancing.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2.14.</td>
<td>Explain how to import appropriate files (STL) from a data system into the rapid prototyping software.</td>
</tr>
<tr>
<td>2.15.</td>
<td>Explain how to set up the rapid prototyping equipment to achieve the component specification (such as electrical and optical conditions; focal distance; forming speed).</td>
</tr>
<tr>
<td>2.16.</td>
<td>Explain how to place the machine in the correct operating mode, and how to access the program edit facility, in order to make minor adjustments for production.</td>
</tr>
<tr>
<td>2.17.</td>
<td>Describe the different materials used to produce components by the rapid prototyping process, and how the various materials used will affect the operating conditions that can be applied relevant to the machine being used.</td>
</tr>
<tr>
<td>2.18.</td>
<td>Describe the reasons why certain materials are suitable for producing components by the rapid prototyping process.</td>
</tr>
<tr>
<td>2.19.</td>
<td>Describe the importance of knowing when components can be unloaded from the machine in relation to the different rapid prototyping processes.</td>
</tr>
<tr>
<td>2.20.</td>
<td>Describe the importance of handling and storing materials correctly and linking to the correct documentation.</td>
</tr>
<tr>
<td>2.21.</td>
<td>Describe the problems and defects that can occur in components produced by rapid prototyping processes, how these can occur, and what preventative actions are needed to overcome them.</td>
</tr>
<tr>
<td>2.22.</td>
<td>Explain when to act on their own initiative and when to seek help and advice from others.</td>
</tr>
<tr>
<td>2.23.</td>
<td>Describe the importance of leaving the machine in a safe condition on completion of the rapid prototyping activities (such as correctly isolated, operating programs closed or removed, cleaning the machine, and removing and disposing of waste).</td>
</tr>
<tr>
<td>Equivalences</td>
<td>N/A</td>
</tr>
<tr>
<td>--------------</td>
<td>-----</td>
</tr>
</tbody>
</table>

© NOCN 2016