



Course: **3D Printing 101 - An Introduction to 3D Design and Printing**

Guided Learning Hours: 18

Pre-requisite: **Basic knowledge of science and technology**

Abstract

In this course on 3D Design and Printing, you will embark on a journey into the fascinating world of 3D printing. Throughout this course, students will engage in step-by-step processes of 3D design, modeling and printing. Students will also learn about different types of materials used, printing technologies and real-world applications of printed designs.

Target Audience

This course is suitable for students, hobbyists, and professionals with the desire to develop foundational knowledge of 3D Printing and acquiring both technical and practical skills to bring their creations to life.

Learning outcomes

On completion of this course, learners will be able to:

- Understand the basics of 3D printing and its advantages
- Compare additive and subtractive manufacturing technologies with their advantages and disadvantages
- Identify various 3D printing technologies and materials
- Identify the parts of a 3D printer and various designs
- Learn about advanced printer features that can reduce manual adjustments and workloads
- Understand the difference between Mesh based and Parametric 3D modeling and their specific uses
- Design simple 3D models in Blender for 3D printing
- Use the 3D slicer software to prepare their model for 3D printing
- Evaluate print quality issues and methods of post-processing

Course Content

1. Introduction to 3D Printing

3D printing technologies, its history and future developments. Additive/Subtractive manufacturing and their use cases.

2. Types of 3D Printers

Explore the most common types of 3D printers: FDM, SLA, DLP, SLS. Explore their advantages and disadvantages.

3. Materials used in 3D Printing

Explore various materials used in 3D printing such as PLA, ABS, ASA, PETG, TPU, PC etc. Identify safety and health concerns.

4. Concepts and Terminologies

Common terms used in 3D printing: filament, extrusion, layer height, infill, etc

5. 3D Printing Process Chain

Evaluating the entire 3D printing process from design to finish.

6. Print Beds in 3D Printers

Identifying the various types of print beds used in 3D printing.

7. Advanced Printer Features

Explore the advanced features offered by more expensive printers and the benefits of these features.

8. Setting up a 3D Printer

Identifying the parts of a 3D printer and its assembly.

9. Introduction to 3D Modeling

Introduction to the basics of 3D modeling software. Exploring mesh based and parametric modeling and creating simple models in Blender for 3D printing.

10. Advanced Modeling and Preparation for 3D Printing

Preparing models for 3D printing and ensuring the design can be printed properly with the printer technology used. Identifying the suitable printing technology for printing specific models.

11. Slicing 3D Models

Exporting 3D models from the 3D modeling software and importing them to the slicer. Customizing print settings and exploring the g-code.

12. Printing a Model

Methods of sending the sliced model to the printer and starting the printing process of the 3D model created previously.

13. Post-Processing and Finishing

Identifying post processing methods to clean up print quality issues.

14. Printer Maintenance and Troubleshooting

Identifying the faulty part based on errors indicated on the printer. Learn how to perform maintenance procedures on the printer.

15. Further Applications of 3D Printing

Real world applications of 3D printing and emerging technologies.

Assessment Criteria

In order to achieve Learning Outcome...	The Learner must be able to...
Introduction to 3D Printing	1. Understand the types of 3D printing technologies 2. Understand when to use additive or subtractive manufacturing as well as advantages and disadvantages of each
Types of 3D Printers	1. Identify the most common types of 3D printers: FDM, SLA, DLP, SLS. 2. Identify their advantages and disadvantages 3. Fully understand the safety, health and environmental concerns with each type
Materials used in 3D Printing	1. Identify the various materials used in 3D printing and their use cases 2. Select the correct material for the printed application 3. Strictly adhere to safety, health and environmental concerns 4. Have appropriate PPE when using different materials 5. Ensure the print area is properly ventilated depending on the material used 6. Understand that some materials have severe reactions on skin contact or long-term exposure to fumes
Concepts and Terminologies	1. Understand the common terms used in 3D printing: filament, extrusion, layer height, infill, support types, etc
3D Printing Process Chain	1. Understand the entire workflow of the entire 3D printing process

Print Beds in 3D Printers	1. Identify the various types of print beds and surfaces used in 3D printers 2. Learn about maintenance and ensuring proper bed adhesion 3. Identify methods to improve print bed adhesion
Advanced Printer Features	1. Understand advanced features that are not available on budget or entry level printers 2. Understand the benefits of these features and why the cost difference may be worth it
Setting up a 3D Printer	1. Identify how to choose the proper surface for your printer, depending on the type chosen. 2. Disassemble and reassemble a printer, ensuring all the parts are installed and aligned properly. 3. Understand how to set up the printer and ensure all calibration has been properly carried out. 4. Understand the need for backup systems in case of power outages by identifying the power requirements of the printer (optional)
Introduction to 3D Modeling	1. Understand the types of modeling: Mesh Based and Parametric 2. Use Blender to navigate and create simple models for printing
Advanced Modeling and Preparation for 3D Printing	1. Understand how to design for 3D printing and what parts of a model may fail to print 2. Learn about overhangs in a model and how to handle these when printing 3. Understand various 3D file formats used in 3D modeling programs 4. Export the 3D model using the STL format used in 3D printing 5. Ensure the model is exported at the correct scale

Slicing 3D Prints	1. Know about the different slicer software available and which to use 2. Configure basic print settings for printing: layer height, infill, supports 3. Position models for the outcome desired: print quality, speed, material savings 4. Learn how to perform additional calibration prints to refine print quality
Printing a Model	1. Identify the methods to load the g-code to the 3D printer 2. Understand that some printers have WiFi/LAN and Cloud connectivity options 3. Send the 3D model to the printer for printing 4. Monitor the printing process for issues on start
Post-Processing and Finishing	1. Understand that print settings such as layer height can produce visible layer lines when printing 2. Understand that various post-processing methods are available depending on the material used 3. Identify the proper method to use when smoothing print surfaces 4. Learn how to join multiple printed parts and fill gaps in the print. 5. Learn about protecting the print from environmental conditions
Printer Maintenance and Troubleshooting	1. Use fault codes on the printer to check manufacturer documents and websites for troubleshooting 2. Understand that maintenance needs to be carried out frequently on the printer to ensure proper operation 3. Understand safety procedures when performing printer maintenance and use of proper PPE

Further Applications of 3D Printing	1. Identify real world applications of 3D printing 2. Prepare a plan for 3D printing a model for one real world application 3. The plan must include: - 3D printing technology - Material to be used - Safety considerations - Environmental considerations - Required PPE - Any post processing needed - Any additional considerations
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Essential Learning Resources:

Learners will need access to a wide range of publications relating to 3D printing and a suitably equipped laboratory for practical training. Various manufacturer products, specifications and reference data would also be beneficial to learners.

Location:

SBCS Global Learning Institute

Websites

Creality

<https://www.creality.com>

Prusa

<https://www.prusa3d.com>

Bambu Labs

<https://bambulab.com/en>

Elegoo

<https://www.elegoo.com/collections/3d-printing>

OrcaSlicer

<https://github.com/SoftFever/OrcaSlicer>

Ultimaker Cura

<https://ultimaker.com/software/ultimaker-cura>

Blender

<https://www.blender.org>