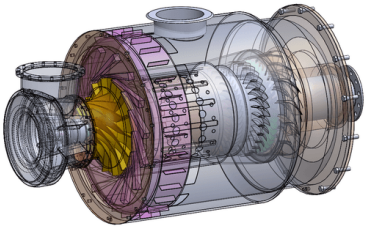
Block 2. Design:

Module 1. 3D Design

1.1 Advanced CAD

3D CAD (Computer-Aided Design) is used in hardware design to create, visualize, and simulate mechanical components, enclosures, and assemblies in a digital environment. It enables engineers to optimize designs for manufacturability, thermal management, and structural integrity before production.

Task: Read this article and answer the following questions.



What is the primary function of CAD software in hardware design?

a) To manually draft designs using traditional tools.
b) To create, modify, analyze, and optimize designs in a digital space.
c) To manufacture hardware components directly.
d) To replace the need for prototypes entirely.

How has CAD software transformed the hardware design process compared to manual drafting?

a) It has made the process more time-consuming.
b) It has increased the likelihood of errors.
c) It has allowed for greater precision and efficiency.
d) It has eliminated the need for any design tools.

Which of the following is a benefit of using CAD software in manufacturing?

a) Increased design errors.
b) Reduced time-to-market.
c) Higher production costs.
d) Limited design flexibility.

What advantage does parametric modeling in CAD software provide to designers?

a) It restricts design modifications.
b) It allows automatic adjustment of dimensions and relationships.
c) It eliminates the need for simulations.
d) It requires manual updates for each design change.

Why is the ability to simulate and analyze designs before manufacturing important?

a) It increases the number of physical prototypes needed.
b) It helps identify potential issues and optimize designs, reducing costs and speeding up production.
c) It delays the design-to-production process.
d) It decreases design accuracy.

1.2 Blender

Blender is an open-source 3D creation software used for modeling, sculpting, rendering, animation, and visual effects. It is used in neurotechnology to model brain structures, simulate neural implants, and visualize complex anatomical data. It helps hardware developers create detailed, accurate representations of neurotech devices, ensuring precise integration with biological systems.

Task: Use this link to download Blender and follow the steps to understand the software's user interface. Keep this link as a resource or for further reading.

1.3 MeshLab

MeshLab is software for editing and optimizing 3D meshes. It is commonly used in 3D scanning, reverse engineering, and digital fabrication. In neurotechnology, it refines brain models and neural implant designs by cleaning and analyzing complex geometries.

Task: Download Meshlab and watch this video on the basic navigation system. Next, watch this video on filtering cleaning.

Task: Read this entire document and answer the following questions.

1. What is the primary purpose of MeshLab?

a) Creating 2D animations
b) Editing, cleaning, and processing 3D captured data
c) Designing blueprints for construction
d) Simulating physical forces in a virtual environment

2. Which of the following is NOT a method for loading 3D data into MeshLab?

a) Using the "File" tab in the menu bar
b) Importing a mesh via the quick access button
c) Dragging and dropping the 3D file into the GUI
d) Scanning an object directly into MeshLab

3. What is the function of the "Pan" tool in MeshLab?

a) Rotates the 3D model
b) Moves the 3D model across the display screen
c) Adjusts the brightness of the 3D model
d) Changes the rendering mode of the model

4. What tool in MeshLab allows you to measure distances between two points in a 3D model?
a) Grid Tool
b) Edge Decorator Tool
c) Bounding Box Tool
d) Measurement Tool

Module 2. 3D Rendering
2.1 Reverse Engineering and Spatial Visualization
Spatial visualization is incredibly useful in neurotechnology as it enables precise placement and design of neurostimulators, brain-computer interfaces (BCIs), and implantable devices, and assists in optimizing circuit layouts and mechanical enclosures to fit complex anatomical structures with minimal invasiveness.

Task: Watch this video and understand how you will apply reverse engineering and spatial visualization.

2.2 CAD Skills
Rendering is the process of generating a visual representation from a model using computer software. It involves transforming data, such as 3D models or simulations, into images, animations, or simulations that can be viewed and analyzed. After making a design

Task: Watch this video and follow the steps to complete rendering.

Module 3. 3D Printing (This is done through TIW - Canvas modules & test of completion)
3.1 Basics
3D printing, or additive manufacturing, is a process where objects are built layer by layer from a digital model. It starts with a design, typically created in CAD software, which is converted into a printer-readable format such as STL or OBJ. The model is sliced into thin layers, and the printer uses materials like PLA, ABS, resin, or metal to construct the object. Common methods include FDM (Fused Deposition Modeling), SLA (Stereolithography), and SLS (Selective Laser Sintering). After printing, objects often require post-processing. 3D printing is widely used in prototyping, manufacturing, medical applications such as custom prosthetics, and artistic creation, offering fast and cost-effective production with minimal material waste.

Task: Enroll in the TIW Canvas page here. Complete the “Culture and Community” module on Canvas and submit a screenshot of completion.

3.2 TIW Training: Bambu Lab P1P 3D Printing Training
The Bambu Lab P1P is a compact and versatile 3D printer designed for both beginners and experienced users. It features a dual extruder system, enabling the printing of multi-material objects, and boasts high print speed and precision. With a build volume of 256 x 256 x 256 mm, it's suitable for creating a wide range of prototypes and models.

Task: Complete the “Bambu Lab P1P 3D Printing Training” module on Canvas and submit a screenshot of completion.

3.3 TIW Training: Advanced Filament Printers (Raise 3D)
Raise3D's Advanced Filament Printers offer high-quality, reliable 3D printing for professional use. They support a wide range of materials, including PLA, ABS, Nylon, PETG, and composites. Models like the Pro2 feature dual extrusion for printing complex multi-material objects.

Task: Complete the “Advanced Filament Printers (Raise 3D)” module on Canvas and submit a screenshot of completion.

3.4 TIW Training: SLA 3D Printing
SLA (Stereolithography) printing uses light to cure liquid resin into detailed, solid objects. It is ideal for high-precision applications like dental models or fine prototypes.

Task: Complete the “SLA 3D Printing” module on Canvas and submit a screenshot of completion.