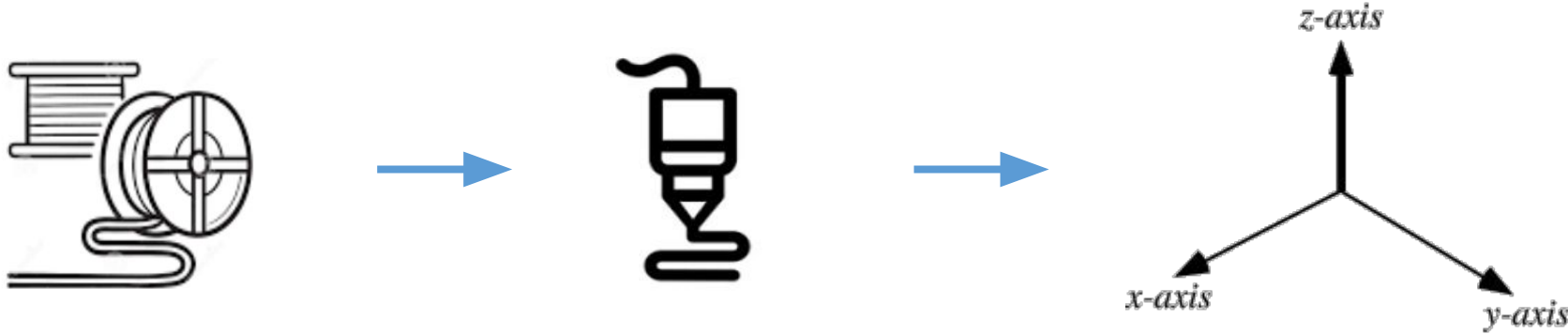


# 3D PRINTING

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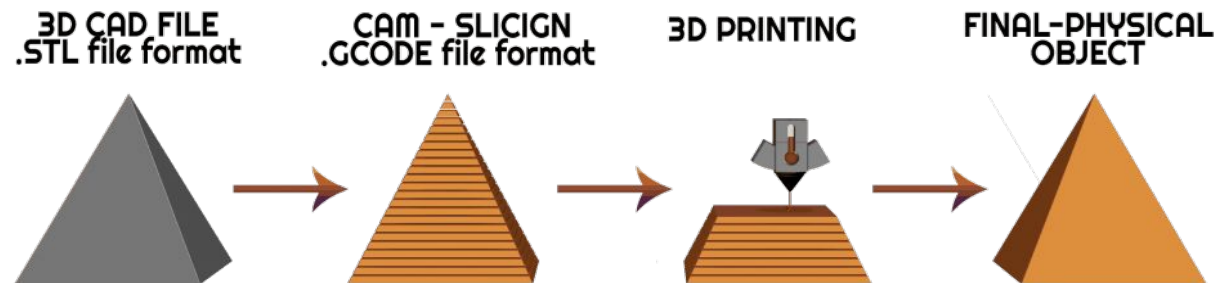
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# How 3D Printing Works?



## Hardware:

**Filament** from a variety of material available is fed into the **hot end**. A **microcontroller** gives command to the hot end to travel along the *x*, *y*, and *z* axis while melting the material on the printing bed. Thus forming the shape of any object.

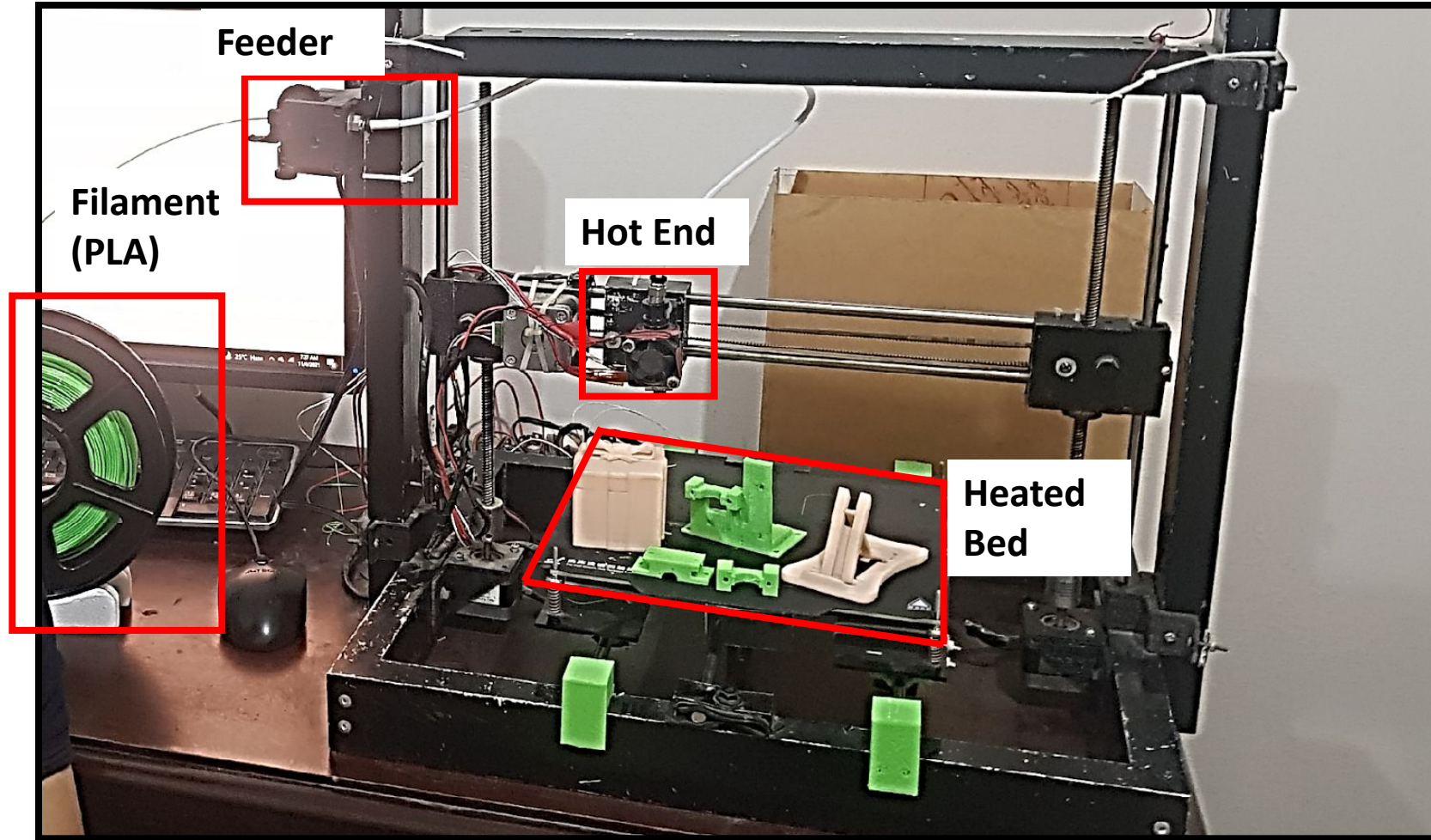


## Software:

When it comes to the software part, the process begins with the CAD modeling of the desired part to be 3d printed. The file is exported as STL format. A separate software converts the STL file into GCODE file. The GCODE contains the printing coordinates of the object.

## What it look likes?

Following is the picture of a 3D printer that was built earlier.



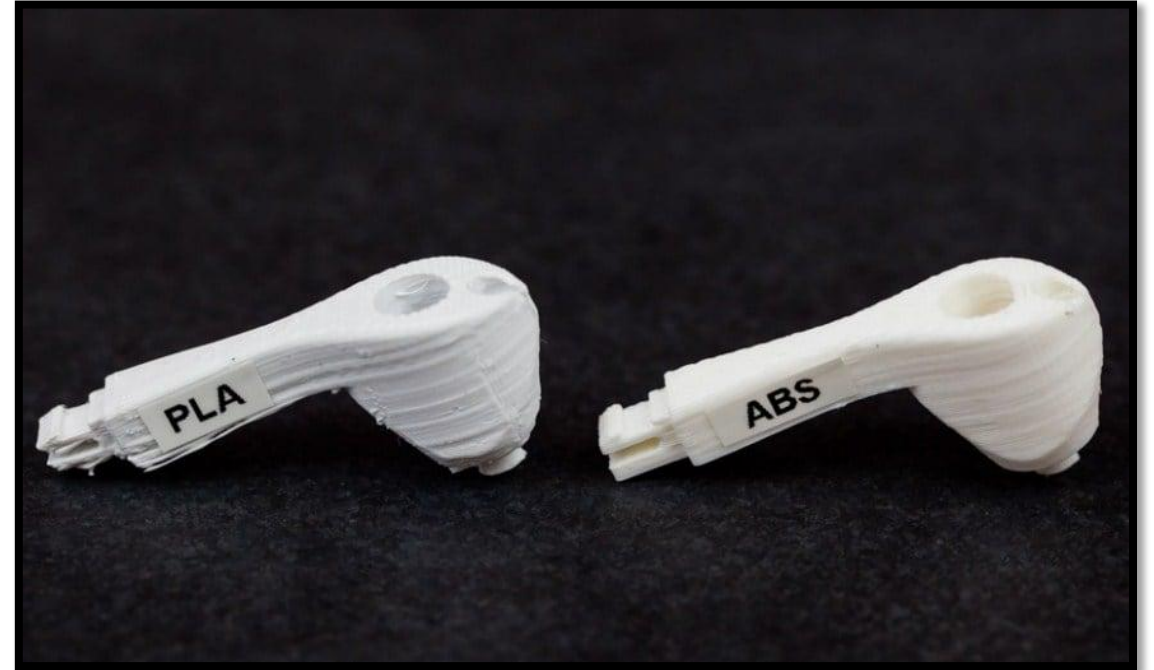
# What materials that can be used for printing?

## 1. PLA

- Easy to work with
- No heated bed required
- Melting point is 180 °C
- Closed chamber is not a necessity
- Price/Kg: PKR 3000~4000

## 2. ABS

- Much more resistant and flexible
- Heated bed is required
- Melting point is 200~260 °C
- Closed chamber is needed
- Price/Kg: PKR 4000~5000



## COMPARISON:

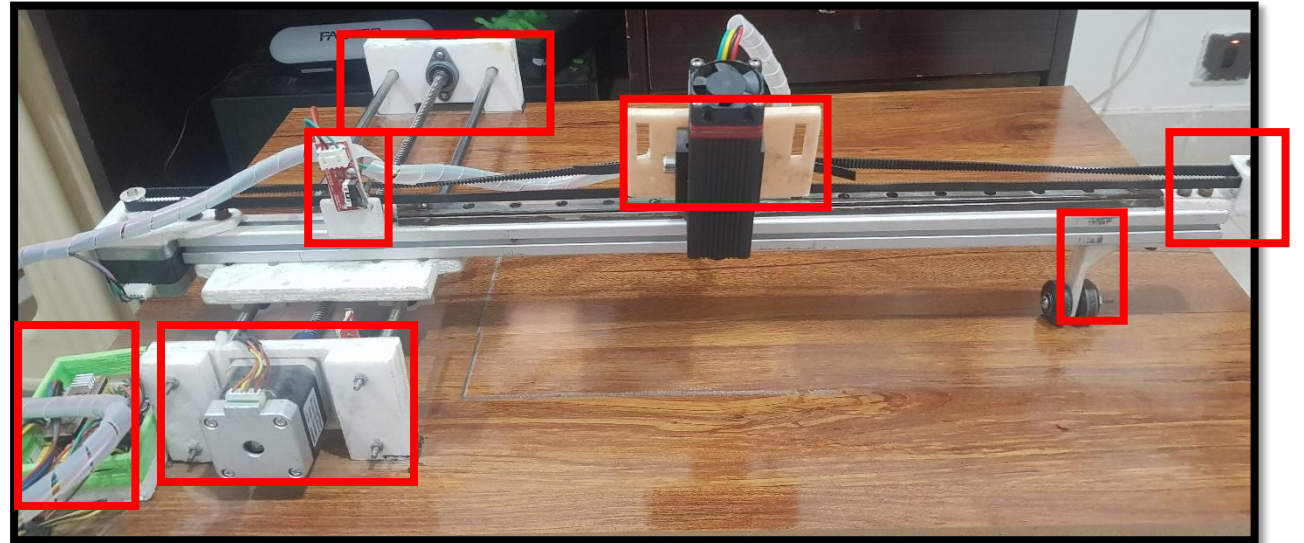
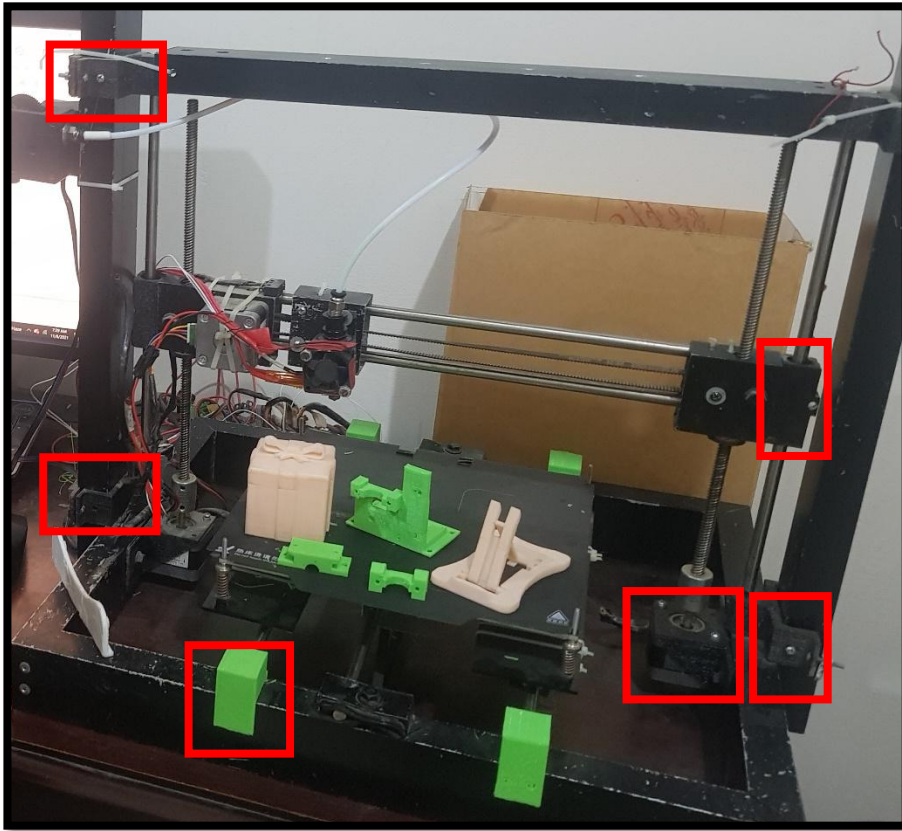
- ABS and PLA are the most common desktop FDM printed materials and are typically similar in cost. ABS has superior mechanical properties but is harder to print with compared to PLA.
- PLA is ideal for 3D prints where aesthetics are important. Due to its lower printing temperature is easier to print with and therefore better suited for parts with fine details.
- ABS is best suited for applications where strength, ductility, machinability and thermal stability are required. ABS is more prone to warping.



# What are the applications of 3D Printing?

## 1. Easy Prototyping:

- Bringing Innovations and developing new projects is easy and quick with a 3D printer, It can come handy in R&D Projects. For e.g. the parts highlighted in Red are 3D printed by the same machine. These part were then used in improving the 3D printer(on the left) and making another CNC machine (on the right).





# How can 3D Printing be helpful?

## 2. Metal Casting:

- 3D printed part are strong enough to sustain many applications, but if the requirement is for heavy application or high wear and tear then we can use that 3D Printed part as a pattern to cast same part in metal. For illustration I got a 3D Printed stepper motor holder casted into Aluminum.



3D Printed part



Casting



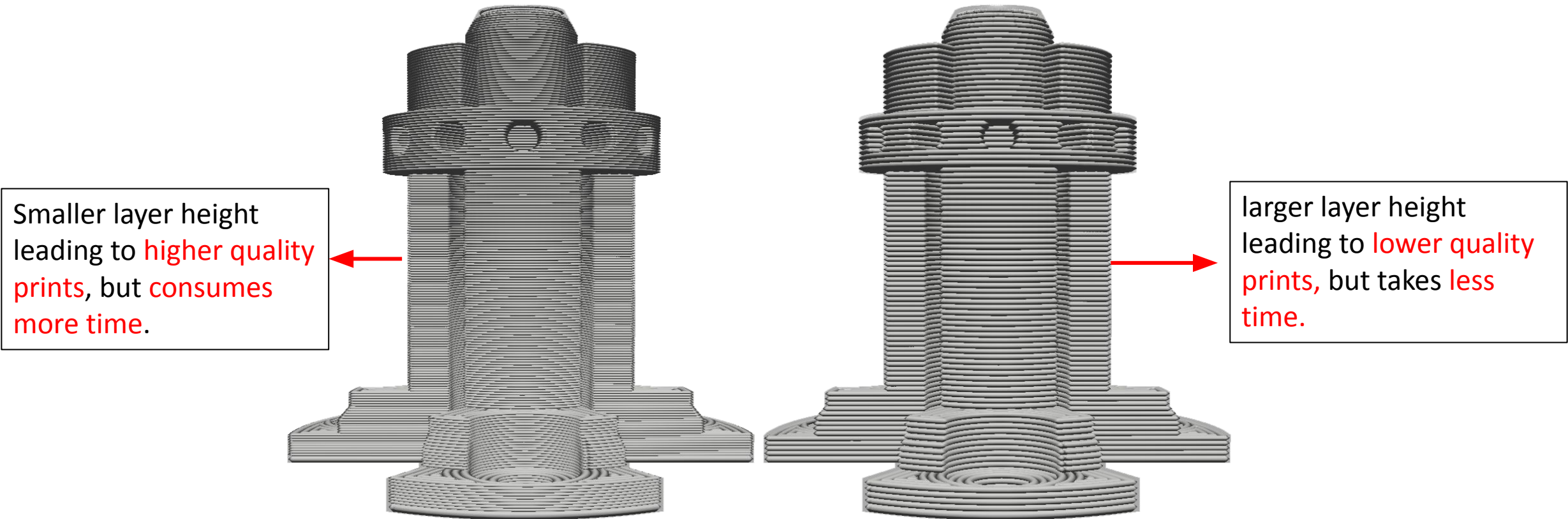
After Casting



After post processing

## What are different print qualities?

The layer height is one of the most frequently changed settings. It is the thickness of one printed layer in millimeters. With a thinner layer height you can increase the quality of the print, leading to a smoother surface and more detail visible in the Z-direction (height) of the model. On the other hand, by using thicker layers you can decrease the print time substantially



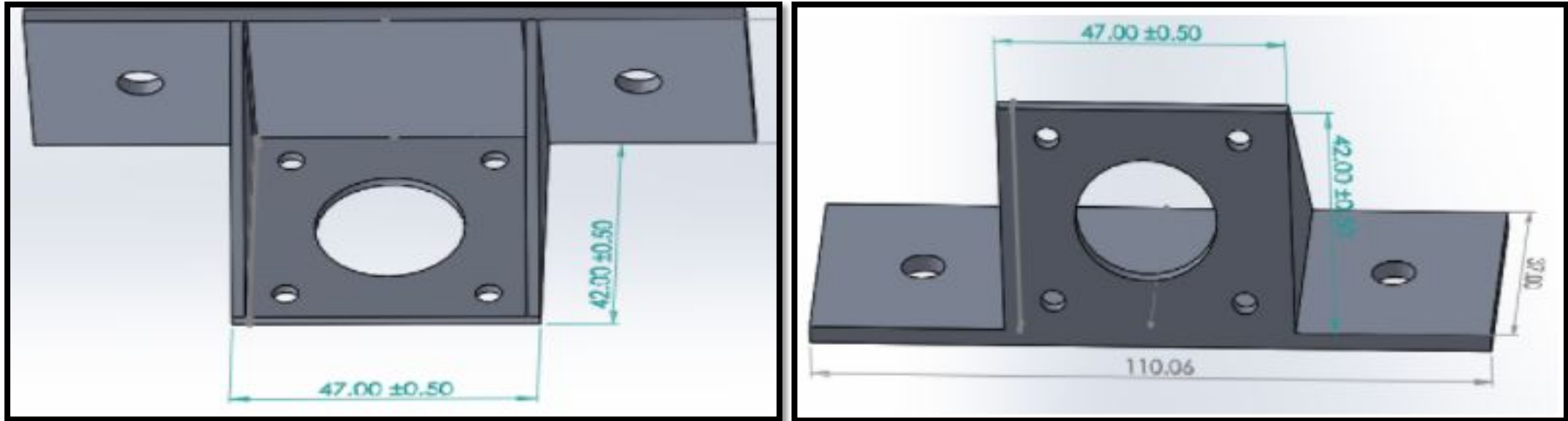
**Dimension Tolerance:  $\pm 0.5\text{mm}$**



# Can we use 3D printer for mass Production?

3D Printing is a time consuming task and it is **not recommended** to be used for mass production.

For example consider we want to print following object with given dimensions(in mm):



At **Infill: 35%** (Infill is % of the material fill and can be between 10~100%)

Then following result were obtained based upon different print qualities

(Print quality refer to layer height as discussed in previous slide)

**Quality : Fine**

**Time consumed:** 180 min

**Weight:** 18 grams

**Quality : Normal**

**Time consumed:** 106 min

**Weight:** 17 grams

**Quality : Draft**

**Time consumed:** 91 min

**Weight:** 16 grams



# Proposed Printer Model

The proposed model will have following features:

- Heated Bed
- Print Capacity: **200 mm \* 200 mm \*200 mm**
- Enclosed walls of Acrylic sheet
- Frame built: Extrusion Aluminum Profile
- Ability to print ABS and PLA material

## Approximate Cost:

PRs. 60,000\*

\* Cost breakdown will be shared later if required

