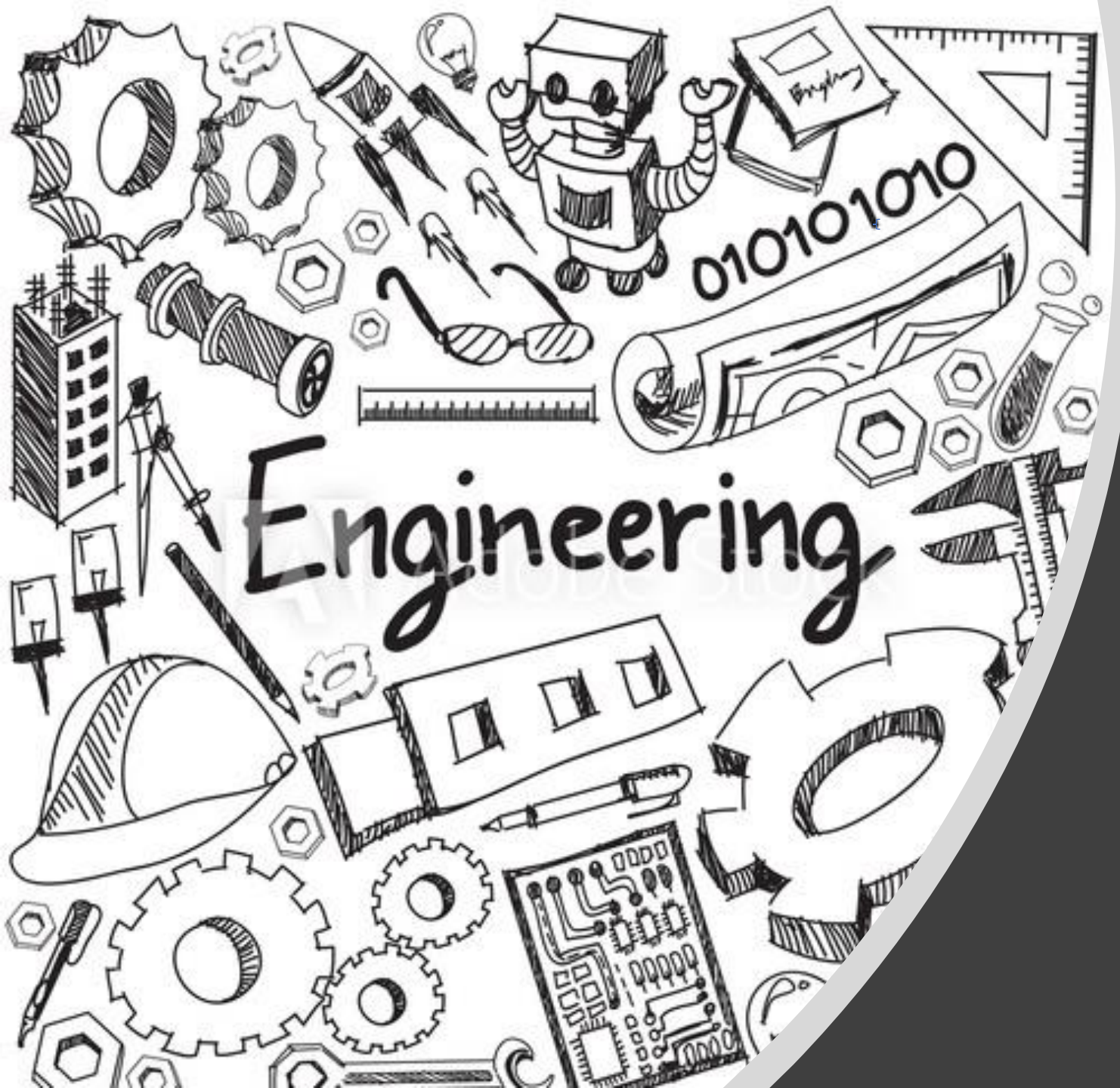


ME-2023
MANUFACTURING
ENGINEERING

REVERSE ENGINEERING OF SOLDERING IRON

GROUP MEMBERS	INDEX NO.	individual contributions
Andrew Ferdinan.S	190170D	20%
Mathiyalagan .V	190387A	20%
Mithunraaj.S	190393M	20%
Rathees.T	190512F	20%
Ravinath.S	190524T	20%

Mechanical engineering department,

University of Moratuwa

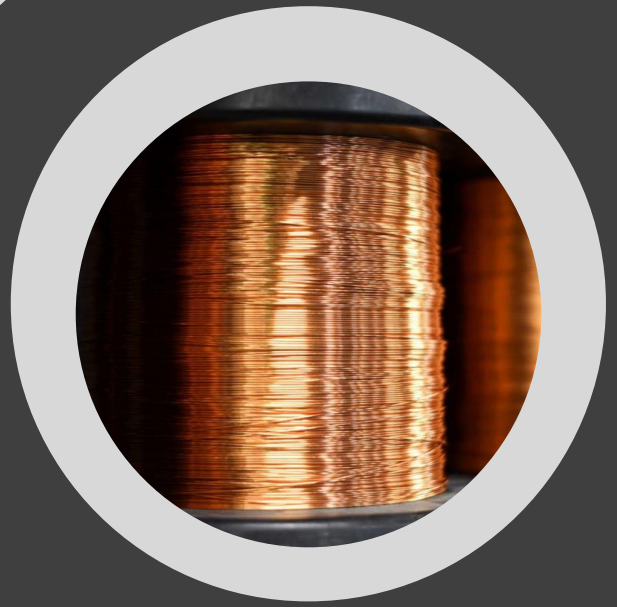
1.0 Introduction

- Soldering is a main process used in manufacturing devices.
- There are several types of soldering iron with unique properties and here we are going to discuss about soft soldering iron
- it is a hand tool used for small joining process to join different types of metals.
- The solder fills the joint by capillary action between closely placed components.
- We are going to briefly explain about the manufacturing process and some other functions here.

Slide author- Andrew Ferdinan.S

Mechanical engineering department,

University of Moratuwa



2.0 COMPONENTS

Components	Raw materials
1. WOOD HANDLE	Wood
2. STEEL TIP	Steel rod
3. Tip enclosure	Stainless steel rod
4. SHEET METAL CASING	Sheet metal
5.NICHROME WIRE	Nichrome
6. COPPER WIRE	Copper
7. INSULATER	Ceramic
8. CONNECTING WIRE	Copper wire covered by plastic
9. SPRING	Steel
10.PLASTIC BASE	Plastic

2.1 MATERIAL SELECTION

2.1.1 wood handle

We need to considering these points when selecting the material for handle.

- Thermo conductivity- low
- Electric conductivity- low
- Availability- high
- Cost- low
- Machinability- high

After considering these points, we can choose plastic and wood materials. In case, if we choose plastic, we need a mold.

2.1.2 steel tip

- We generally use copper and steel as metal tip for soldering iron.
- Mainly we considering two points in selecting tip material.

1.machinability

- due to high plasticity and toughness the machining process will be more complicated in copper but the steel is well processable on machining.

2. thermal conductivity

- copper is very good thermal conductor but steel is moderate.

2.1.2 steel tip

3. Availability

- Compare to copper, Steel has become easier to obtain in market.

4. Cost

- Steel is 10 times cheaper than copper.

5.melting point

- Pure steel makes some issues regarding resolving into the solder. So it’s better to use a steel based alloy.

Therefore, according these factors we choose stainless steel as the tip.

2.1.3 sheet metal casing

- We generally use steel, aluminum, brace, tin, titanium, nickel as selection material for sheet metal casing. We pick stainless steel as selection material for sheet metal casing. Flowing reasons listed below…
  - In order to punch holes in sheet metal, metal should be harder one and should have formability .
  - Good corrosion resistance metal
  - Its cheaper
  - Easy to work
  - Commonly, we use stainless metal is grade 304.

2.1.2 nichrome wire

Nichrome wire is used here to create a huge amount of heat. we choose nichrome due to its properties like,

1. High electrical resistivity at room temperature
2. Have a high melting point of 1400^0 C
3. high resistance for corrosion and oxidation.
4. High thermal conductivity($11.3Wm^{-1}C^{0-1}$)
5. Low specific heat($450JKg^{-1}C^{0-1}$).

2.1.3 connecting wire

- **due to high electric conductivity,copper is our first choice as connecting wire.**

2.1.4 mica

We use mica due to its unique property of high thermal conductivity and high electric resistivity. And,

1. **mica is chemically stable and unreactive**
2. **light weight**
3. **low cost**

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2.1.5 tip enclosure

the function of the tip enclosure is to hold to the tip and nichrome wire. So we need a rigid body for the enclosure, and also it must be a good thermal conductor. So we choose stainless steel because,

- **it matches our requirement**
- **its widely available in our local area**
- **Good machinability**
- **Low cost**

2.1.6 spring

- **purpose of spring is only to hold the soldering iron, so we choose the processable and cheap material. Therefore, we choose low carbon steel Which have enough rigidity. It is easy to process.**

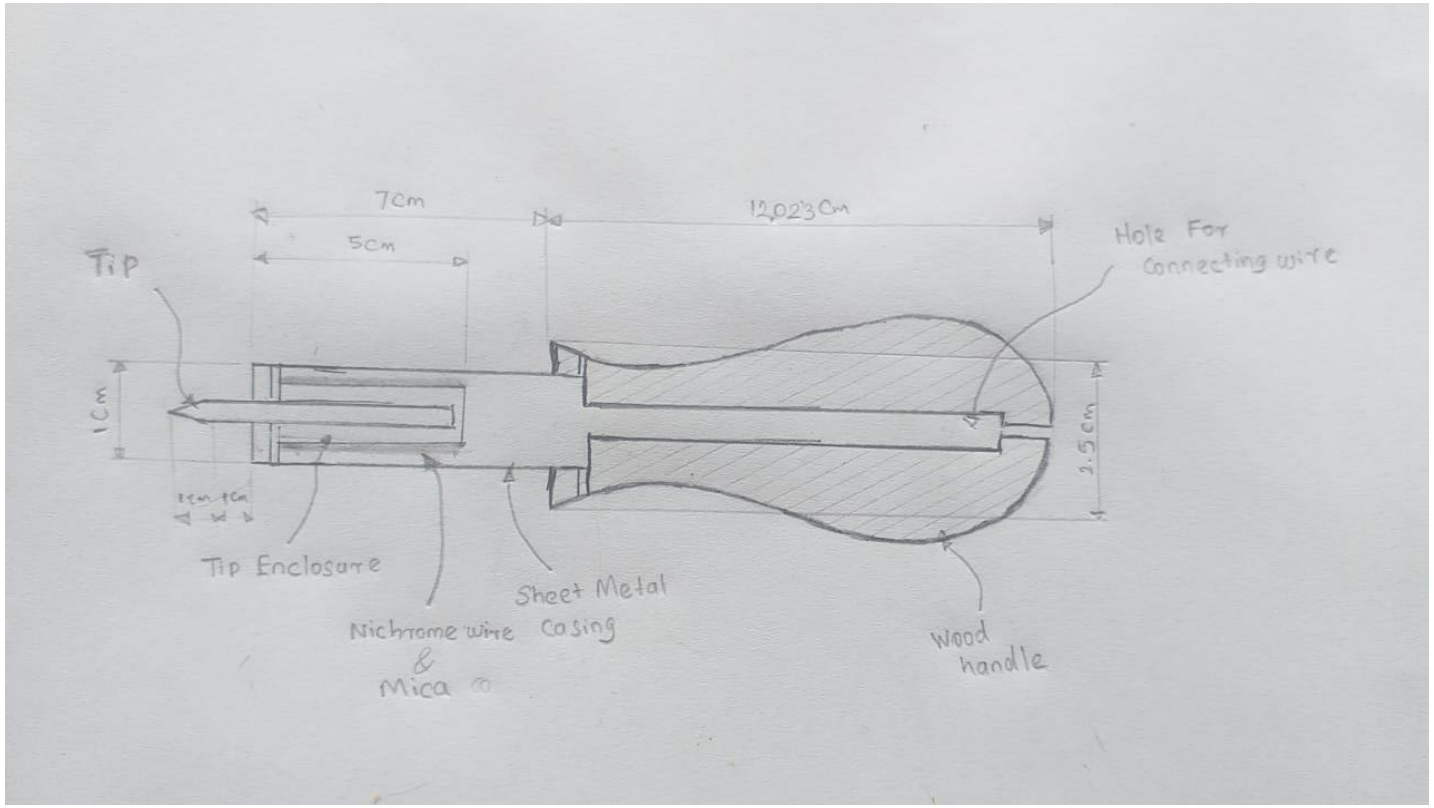
2.1.7 Plastic base

- **We choose phenolic plastic because,**
  - **Excellent flexural and impaction**
  - **Superior heat resistance**
  - **Electric resistance**
  - **Easy to cast**

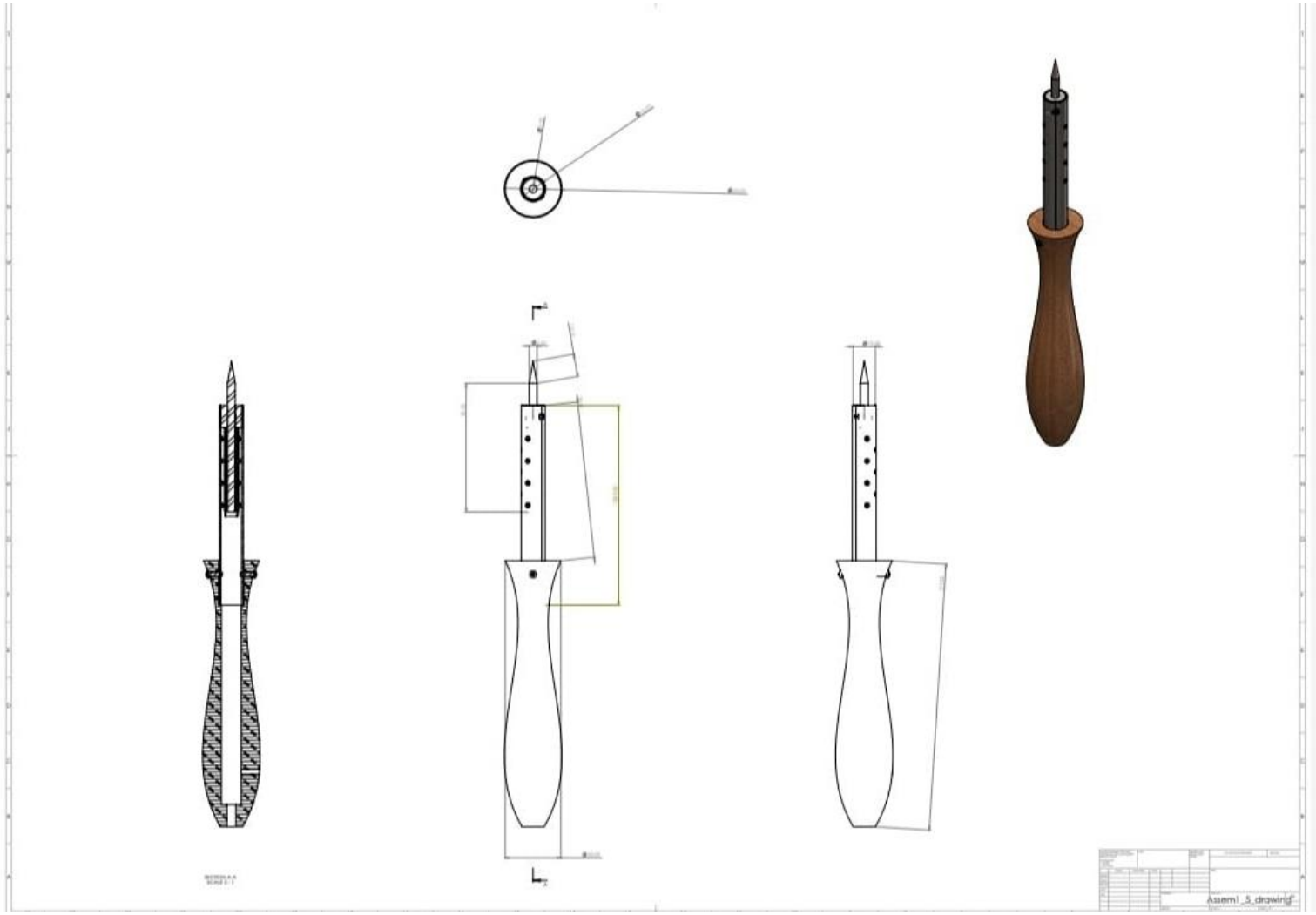
2.2 Material selection test

Wood	visual inspection
Steel	spark test
Sheet metal	visual inspection and magnet test
Conductors	multimeter test

3.1 Free hand sketch



3.2 2D sketch



4.0 COMPONENTS MANUFACTURE PROCESS

4.1 Wood handle

we already discussed the material of handle. We choose soft wood for this purpose.

Our raw material,

we use hacksaw to get dimensions of 15cm length and 5cm x 5cm cross section. then we hold our work piece on bench vise to drill a hole through it to inserting connecting wire.

4.1 Wood handle

- **Afterwards, we are going to fix our workpiece in lathe machine to turn the work piece into cylindrical shape. After that we turn the cylinder to get specific diameter and to get better grip by the cravings. And then cut off the unwanted part on both sides. And finally, we fix the work piece to the three jaw chuck and bore on other side of the workpiece to insert the sheet metal casing.**

4.2 .steel tip

As the first step, we cut the small piece of steel material. And then we fixed it to the lathe machine. And decrease the diameter to required size with straight turning. After that, we face through on one side of the piece and taper turn on other side to get sharp point.

4.3 tip enclosure

- **First of all, we need to select a small stainless steel rod.**
- **Then we need to cut it down according to our scale(5cm). After that we need to straight turn the piece of rod to create a head on one side of the piece. Then drill a blind hole from the head using the drill chuck.**
- **Afterwards, we finish the surface and drill a small hole through the cross section of the head. And make a internal thread using tap.**

4.4 sheet metal casing

- According 3.1.3, we choose material for sheet metal casing. We cut the sheet metal to specific dimension of 9cm length and 3.2cm width.
- after that, we mark few dots with center punch and drill holes. Finally with the help of rolling machine, we roll the sheet metal to a cylindrical shape.

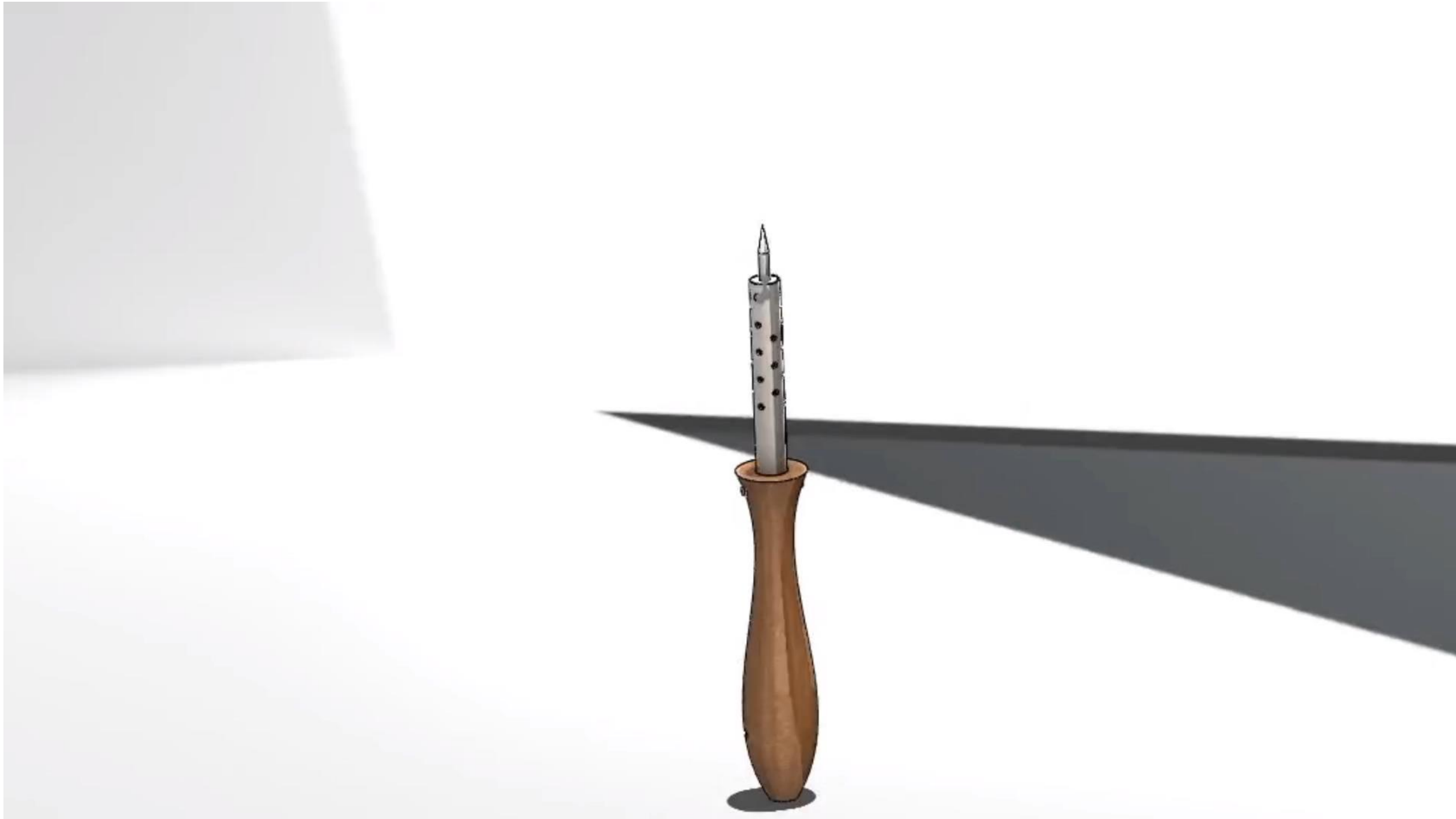
4.5 spring

as we discussed, we choose low carbon steel for spring manufacture due to it’s moderates ductility.

we are going to hold the horn stake in bench vise and place our steel rod over it and hammer the steel rod with a boll bean hammer to get a conical shape spring.

4.6 Plastic base

- **manufacture plastic base by casting it on a rectangular mold. We pour phenolic plastic resin into the mold by melting the plastic pellets.**



5.0 Assemble

- on assembling process, we start with the tip enclosure. We roll a mica sheet over the tip enclosure except the head. Then we tightly wind a nichrome wire very closely. And we need to take connections out from both end of the nichrome wire and connect it to the copper wire which is used for the power connection. Afterwards, we lay another mica sheet over the winding to protect it from the electric conduction to the metal casing.

Assemble

- then we insert our tip enclosure and the whole setup through the sheet metal casing and bring it out to one end of casing.
- Then insert the steel tip into the tip enclosure and keep the tip, tip enclosure, sheet metal casing on a same line of the thread hole Across the head and tight them using a small bolt.
- then, we insert the connecting wire through the wood handle and fix the sheet metal casing tightly into the wood handle. Now our final product is nearly over. We can choose a power adopter according to our conditions and use this product.

conclusion

- We discussed about the component we choose for soldering, then we analyze reasons for material selection and manufacturing process of components. We dismantled and assembled soldering iron to analysis about our previous discussion, and we found that material selection and manufacturing process are the key points of our reverse engineering project.

Thank you

Mechanical engineering department,

University of Moratuwa