MANUFACTURING PROCESS - II
TA212 LAB

Tutor & Course I/C Name :
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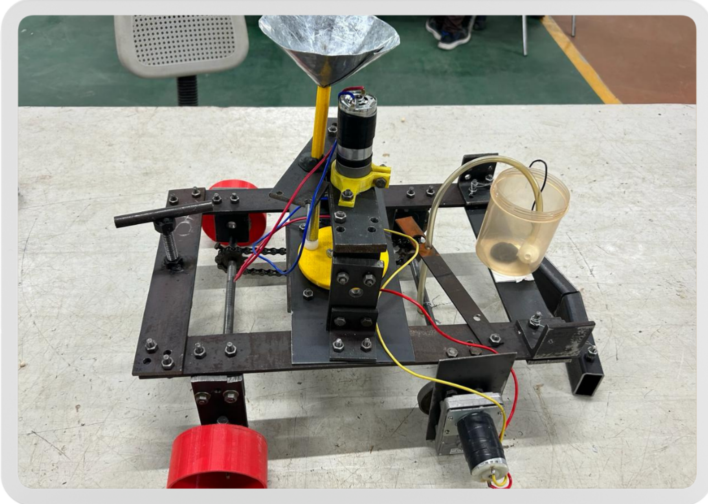
Group No. : 25
Lab Day : Friday



AUTOMATIC SEED SOWING MACHINE

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Year : 2023-24
Semester : 2nd

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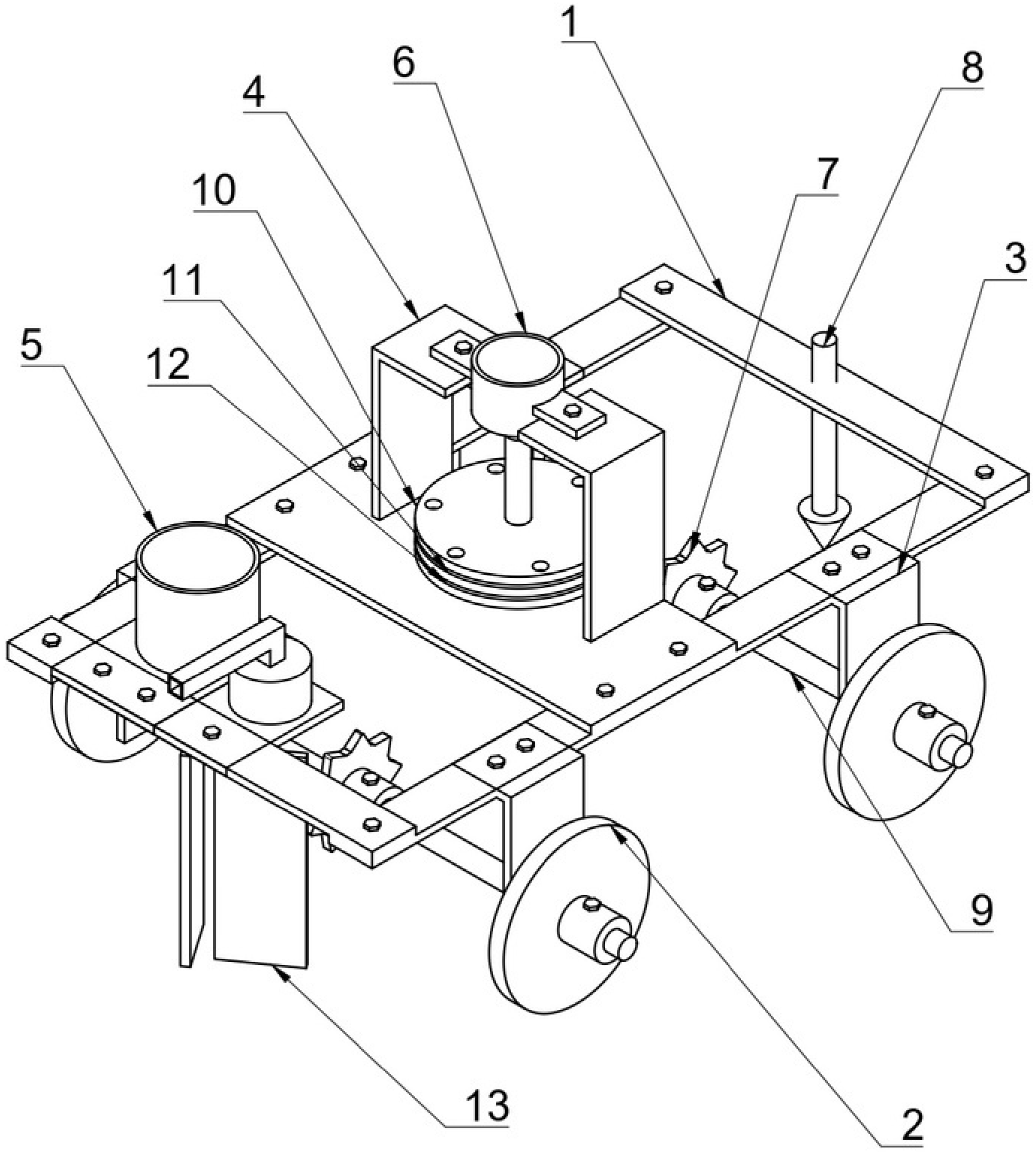
We would also like to express our gratitude to all lab staffs for their constant supervision and encouragement which helped us in the completion of the project.

Abstract

The agricultural sector continuously evolving, demanding efficient solutions to increase productivity. In this context, the seed sowing machine was developed to reduce the human effort to sow the seeds.
From old to now there has huge changes in the seed sowing machine due to tremendous requirements in the field which leads to modification. The advantage is it is a low cost, low maintenance and efficient to use. It significantly reduces labour requirements and operational costs while increasing planting speed and consistency. Moreover, by optimizing seed placement and spacing, the machine promotes uniform crop emergence and growth, leading to higher yields and improved resource efficiency.
In conclusion, the development and deployment of the seed sowing machine represent a transformative step towards sustainable and efficient agriculture.

Isometric Design



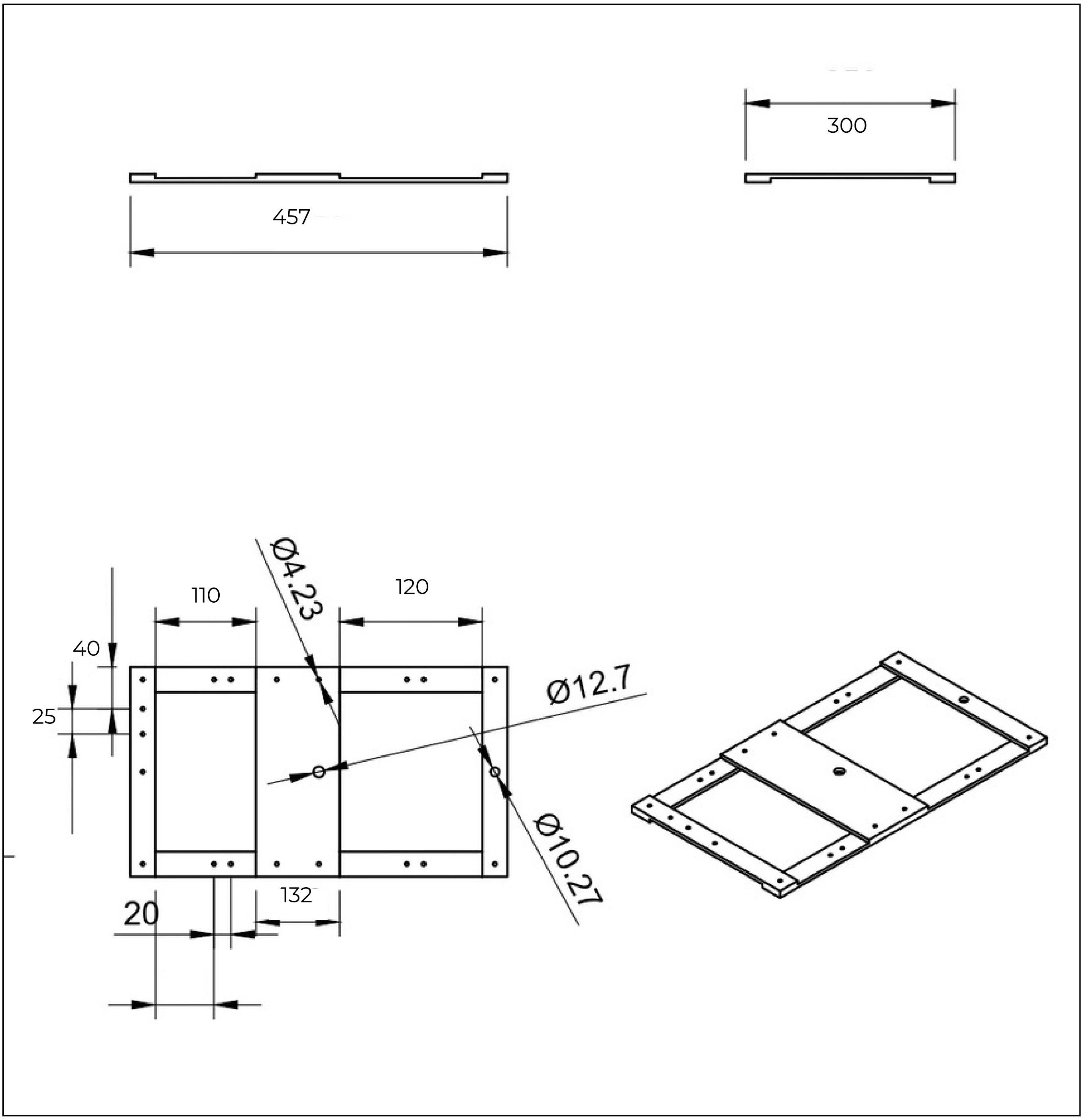
Title : Isometric Drawing of Full Model
Created By : Ramji Yadav (220869)

Parts List

S.No.	Part Name	Quantity	Material Used	Manufactured/ Bought	Machining Process
1	Base Plate	1	Mild Steel	Manufactured	Cutting & Drilling
2	Wheel	4	Mild Steel	Manufactured	Cutting & Drilling
3	Angle	4	Mild Steel	Manufactured	Cutting & Drilling
4	Center Motor Platform	1	Mild Steel	Manufactured	Cutting & Drilling
5	Reservoir	1	Mild Steel and Plastic	Manufactured	Cutting & Drilling
6	Center Motor Holder	1	PLA	Manufactured	3D Printing
7	Sprocket Gear	2	Mild Steel	Manufactured	Lathe & Milling
8	Soil Digging Tool	1	Mild Steel	Manufactured	Cutting & Lathe
9	Wheel Axle	2	Mild Steel	Manufactured	Cutting
10	Center Plate 1	1	Mild Steel	Manufactured	Cutting & Drilling
11	Center Plate 2	1	Mild Steel	Manufactured	Cutting & Drilling
12	Center Plate 3	1	Mild Steel	Manufactured	Cutting & Drilling
13	Center Base Plate	1	Mild Steel	Manufactured	Cutting Drilling
14	Soil Covering Tool	1	Mild Steel	Manufactured	Cutting
15	Chain	1	Mild Steel	Bought	-
16	Pump, Pump & Sprinkler	1	-	Bought	-
17	Humidity Sensor	1	-	Bought	-

Orthographic Drawing (Part-1)

(All dimensions are in mm)

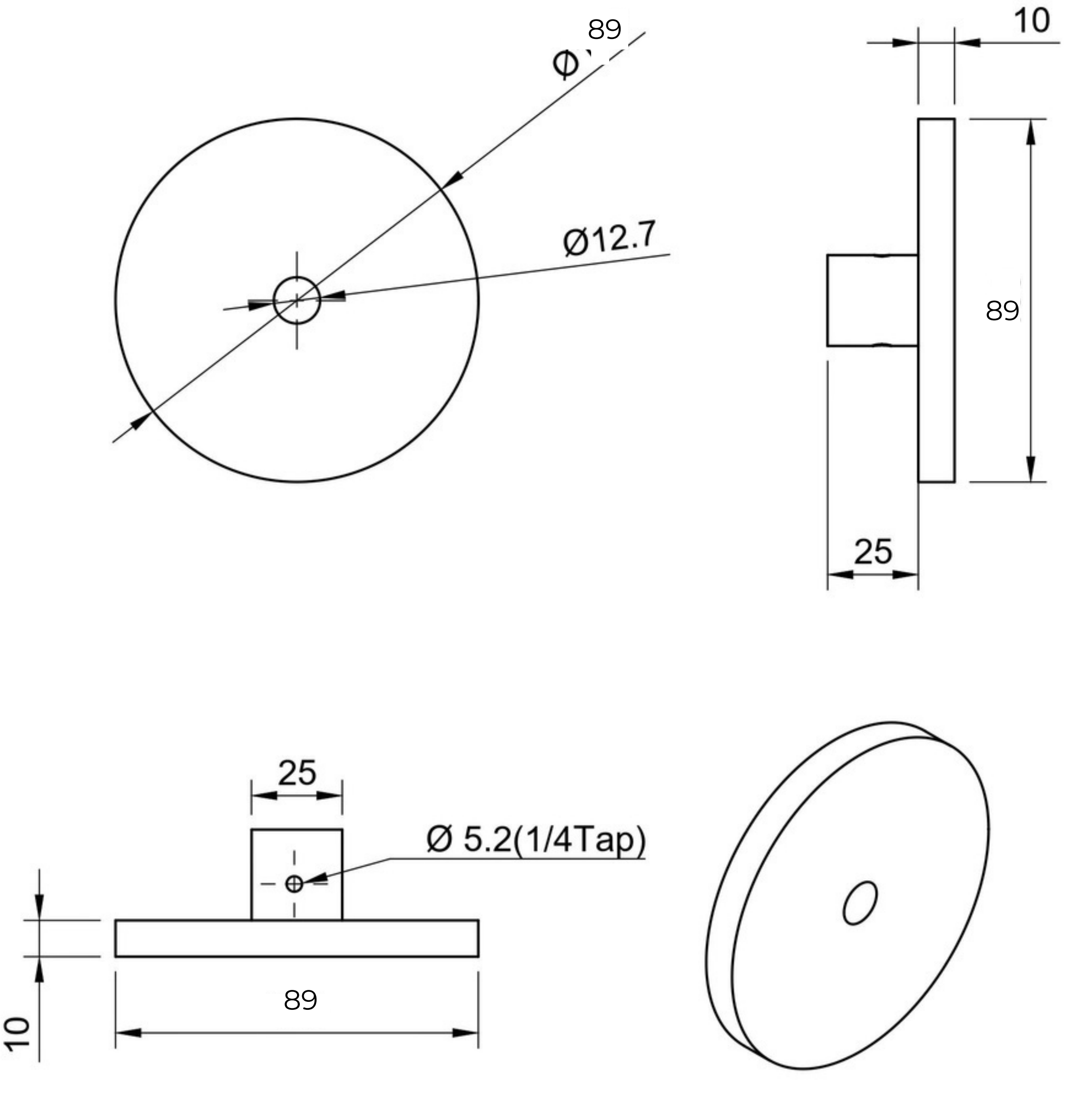


Title : Base Plate

Created By : Ramji Yadav (220869

Orthographic Drawing (Part-2)

(All dimensions are in mm)

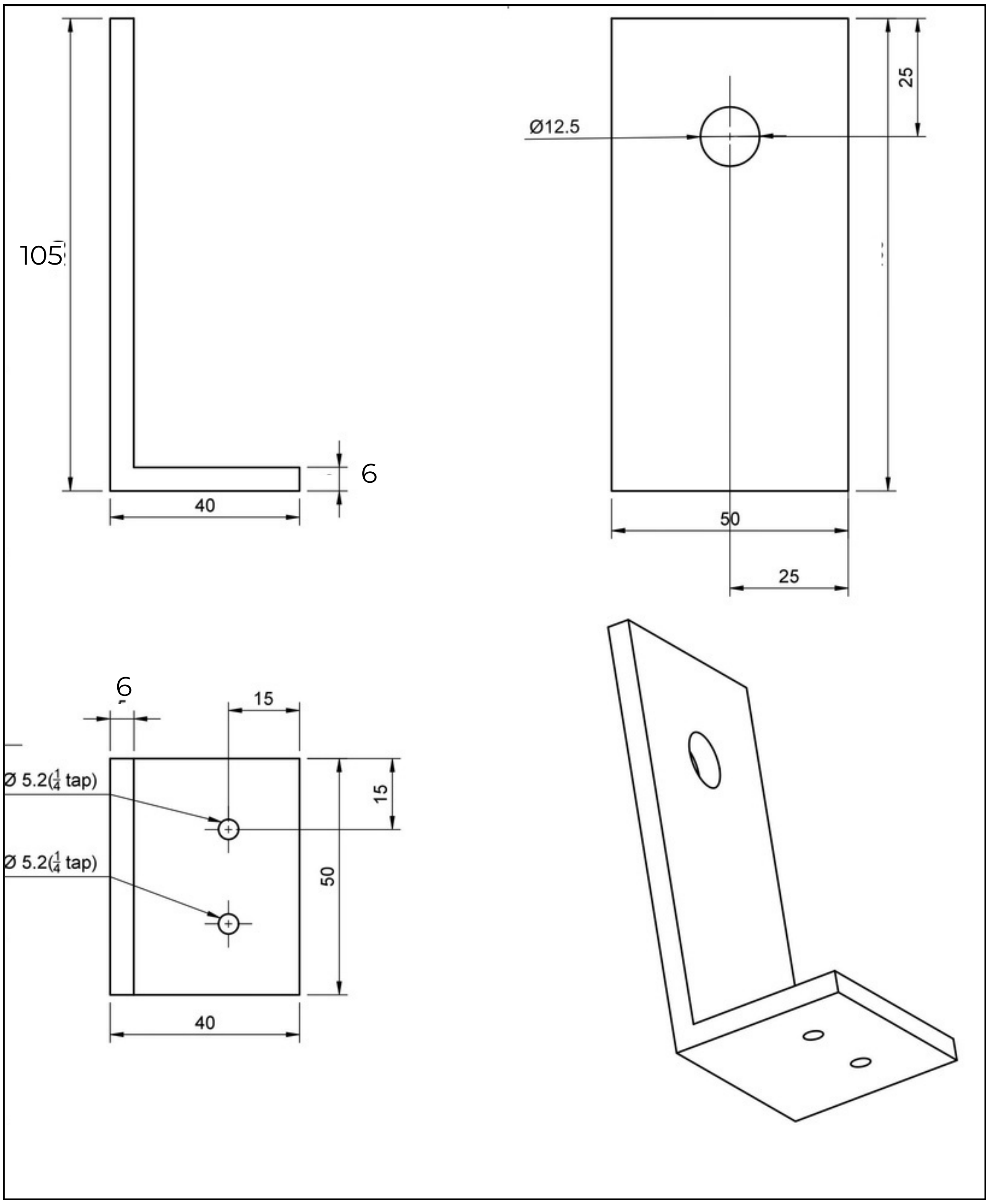


Title : Wheel

Created By : Gattu Tejaswini (220401)

Orthographic Drawing (Part-3)

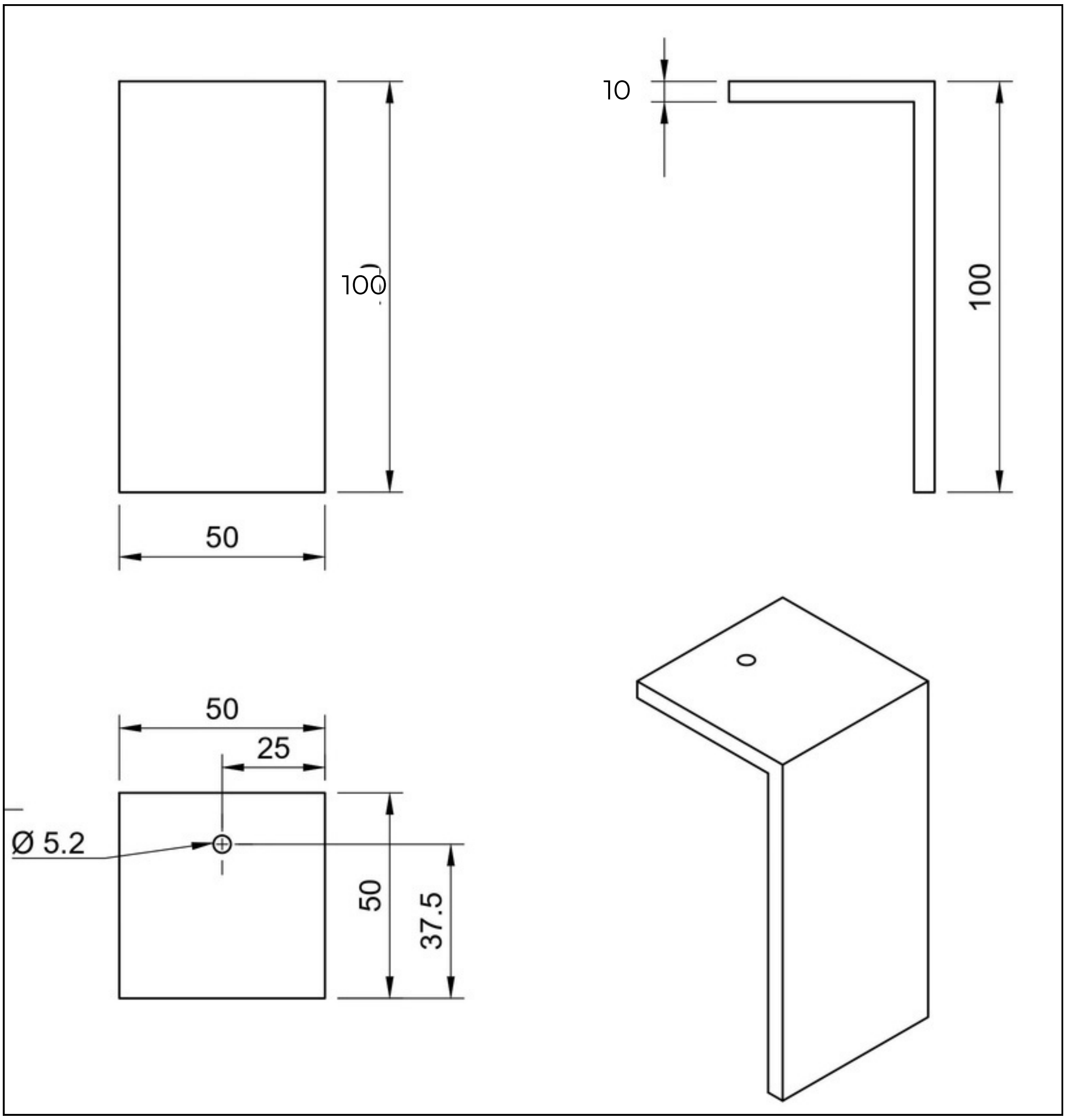
(All dimensions are in mm)



Title : Angle
Created By : Sourav (221081)

Orthographic Drawing (Part-4)

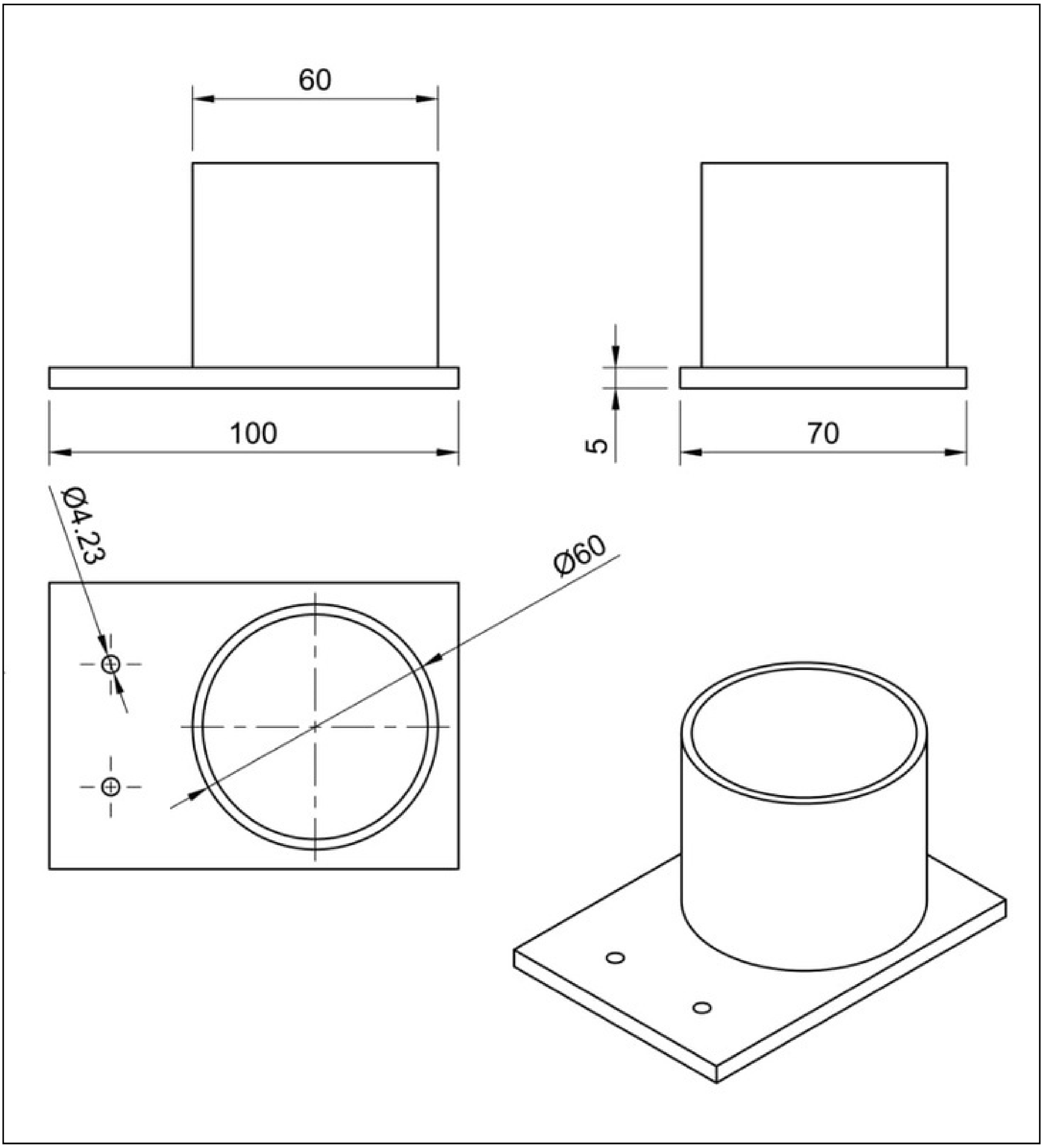
(All dimensions are in mm)



Title : Center Motor Platform
Created By : Arzoo Singh (220231)

Orthographic Drawing (Part-5)

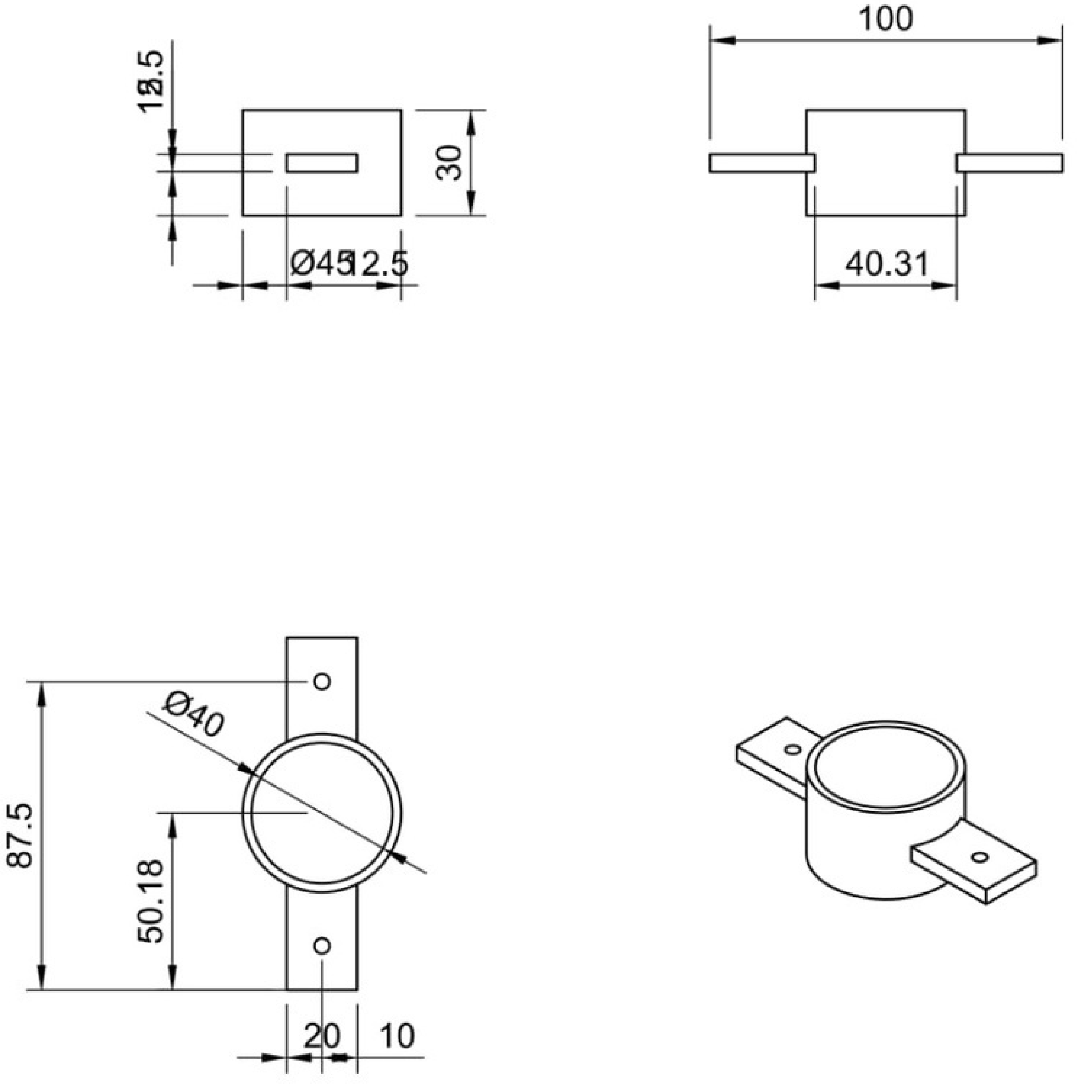
(All dimensions are in mm)



Title : Reservoir
Created By : Abhinav Kumar (220037)

Orthographic Drawing (Part-6)

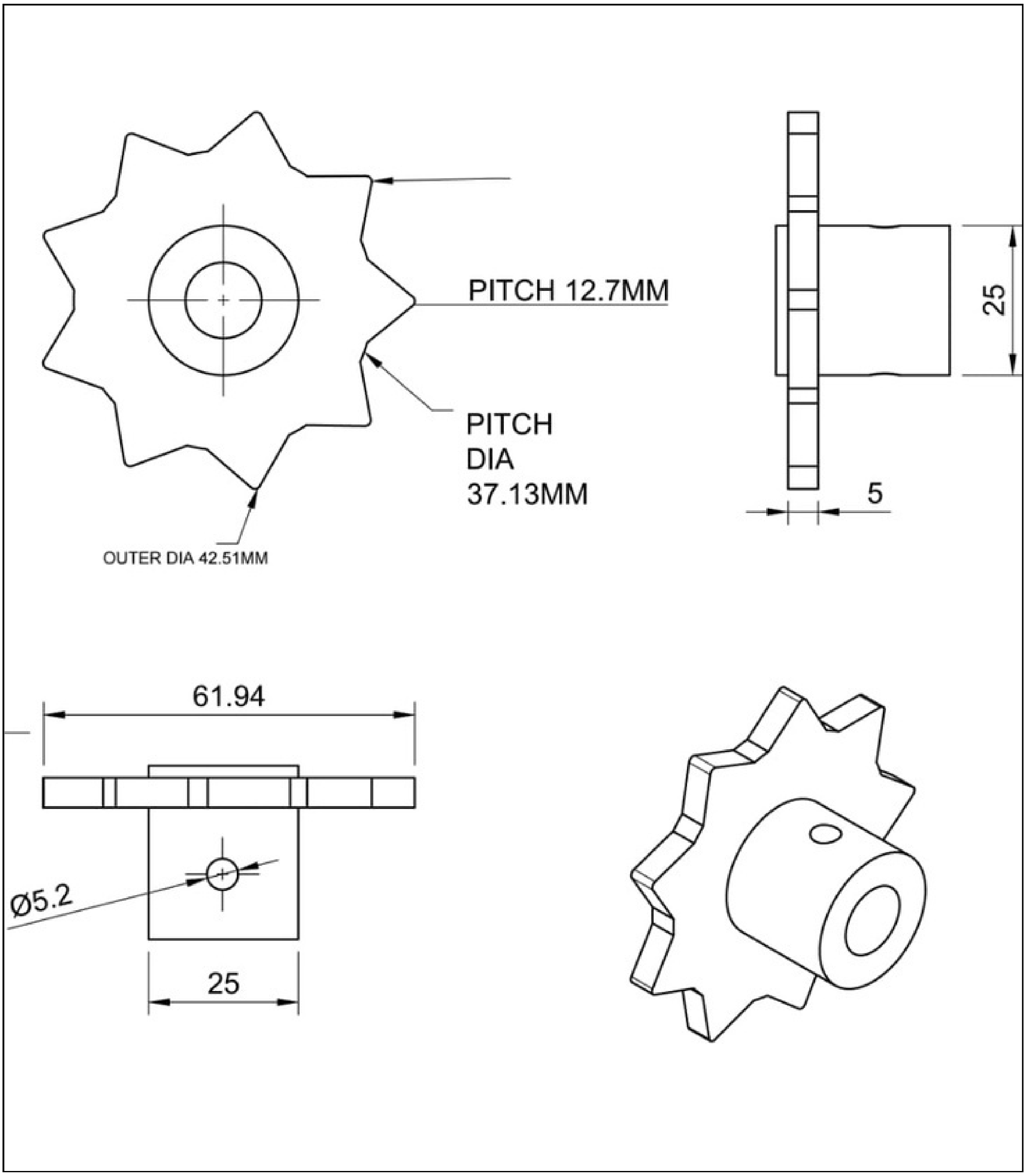
(All dimensions are in mm)



Title : Motor Holder
Created By : Meghana (221140)

Orthographic Drawing (Part-7)

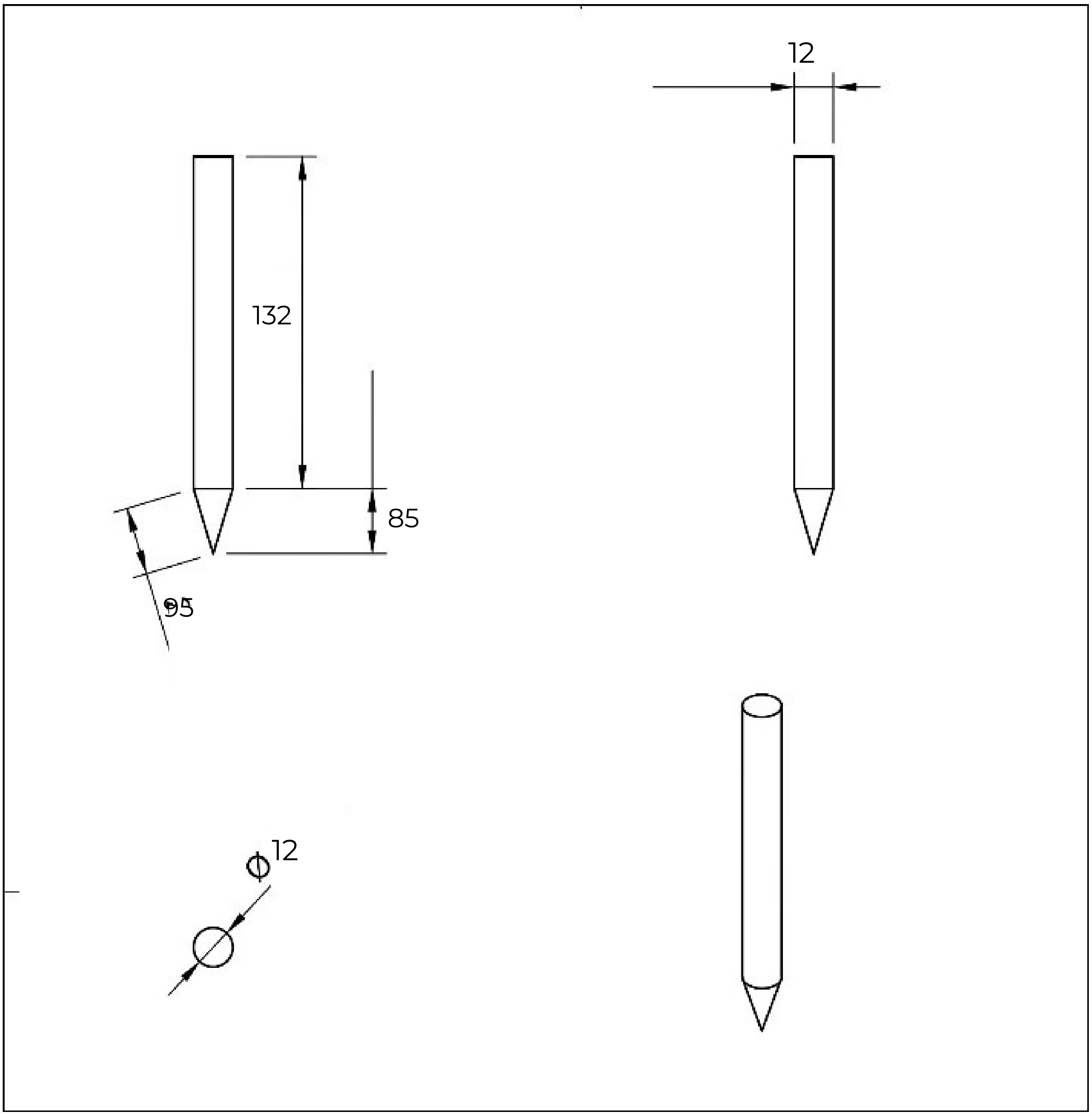
(All dimensions are in mm)



Title : Sprocket Gear
Created By : Abhinav Kumar (220037)

Orthographic Drawing (Part-8)

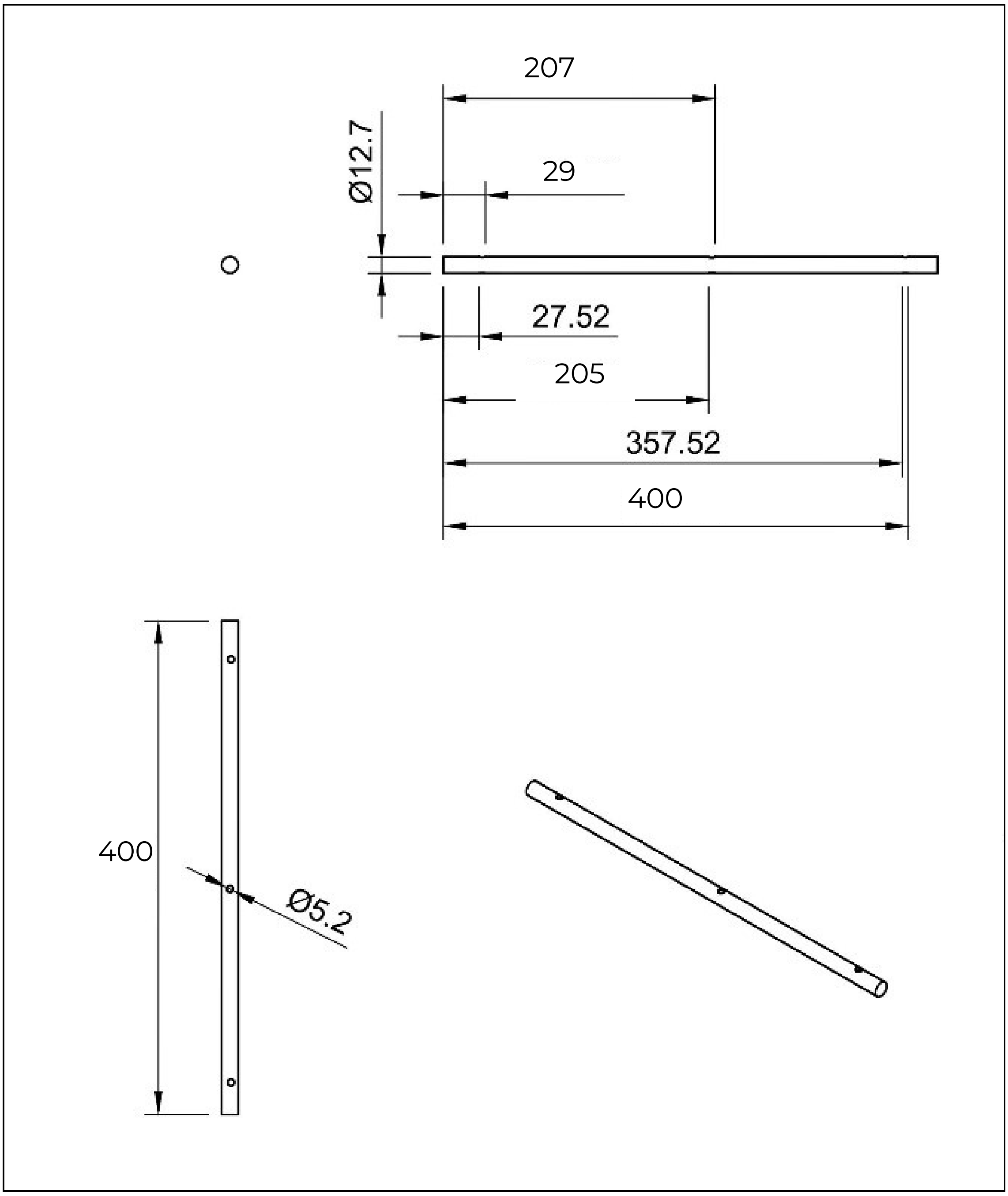
(All dimensions are in mm)



Title : Digging Tool
Created By : Meghana (221140)

Orthographic Drawing (Part-9)

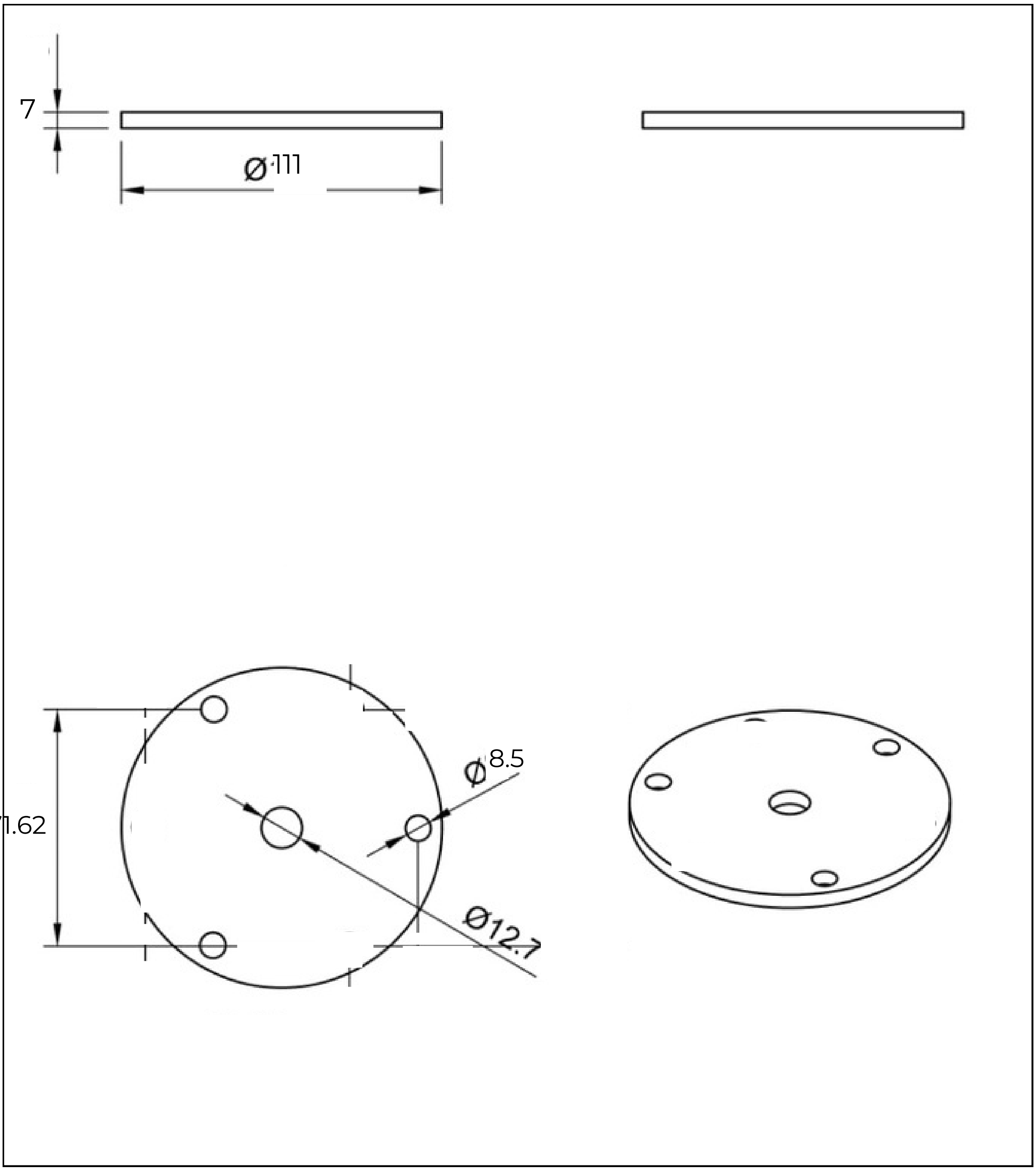
(All dimensions are in mm)



Title : Wheel Axle
Created By : Arzoo Singh (220231)

Orthographic Drawing (Part-10)

(All dimensions are in mm)

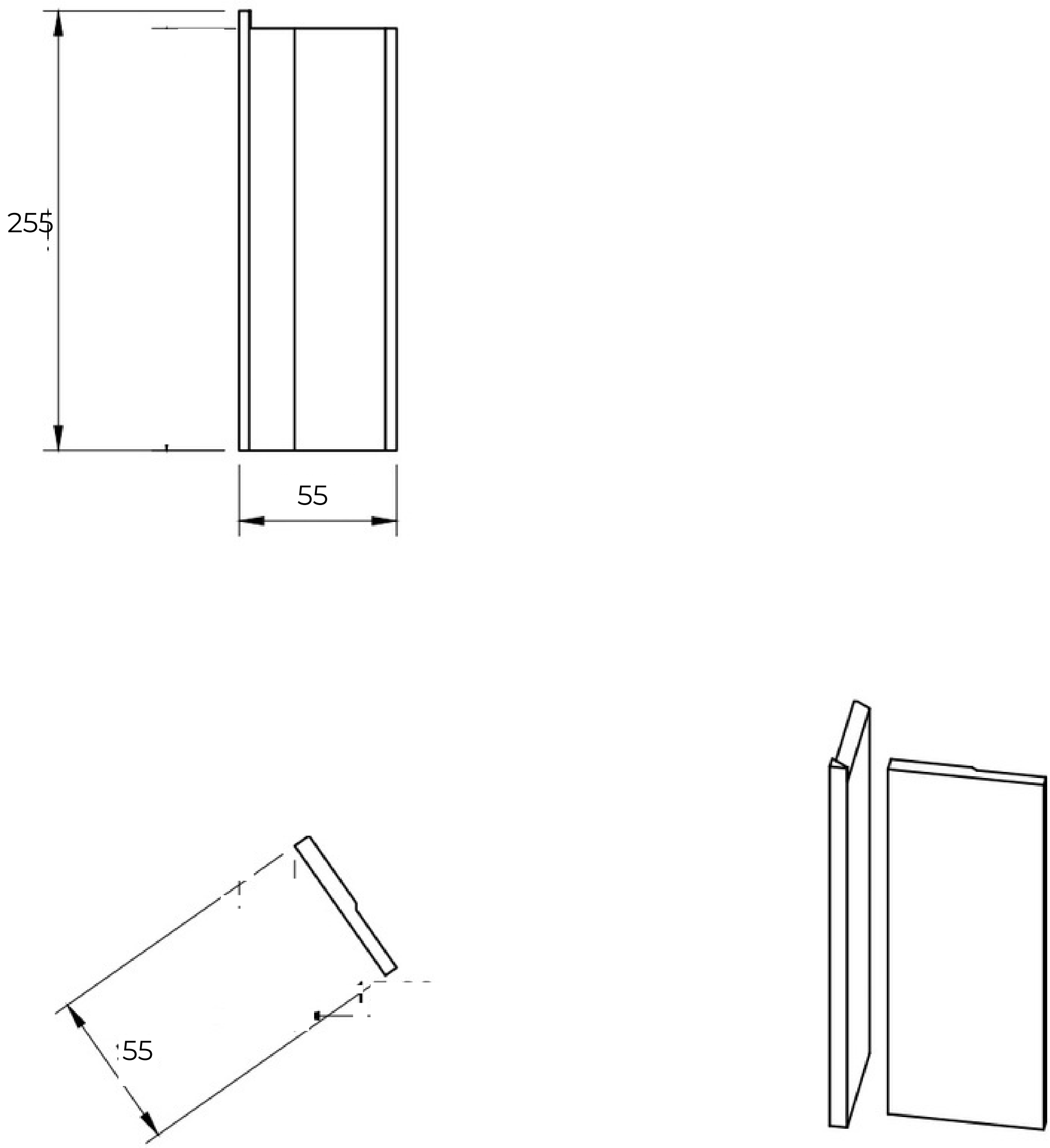


Title : Center Plate-1

Created By : Arram Sirichandana (220208)

Orthographic Drawing (Part-13)

(All dimensions are in mm)



Title : Soil Covering Tool

Created By : Dnyaneshwar Ramesh Pawar (220384)

Calculations for Sprocket Gear

Number of Teeth (N) = 9

Pitch(P) =12.7mm

Pitch Diameter = P/sin (180/N) =12.7/sin (20)

= 37.13 mm

Outside diameter of gear = P*(0.6 +cot (180/N))

= 12.7(0.6 +2.7474)

= 42.51 mm

Force And Torque Analysis

Size a motor to rotate/index a table

Step 1: Size the table

• If diametrical, set the diameter (D), and the thickness (t) • If square/rectangular, set, specify the size (A, B) and the the thickness (t) • Specify the material too (density, ϱ)

Diameter=0.1m

Thickness=0.005m

Density=7850kg/m^3

Inertia of the diametrical table: $Jt = \pi$ 32 ϱtD 4=3.85*10^-4 kgm^2

Step 2: Specify the size of the shaft driving the table • Specify the shaft diameter ($D2$) and its length (L) • Specify the material too (density, ϱ)

Diameter=12.7mm

Lenth=50mm

Inertia of the drive shaft: $Js = \pi$ 32 ϱLD^ 4 = 1*10^-6 kgm^2

Step 3: Size the load the table is carrying, if any:

Define how many such loads (n) the table needs to index/rotate • Define the distance from the table center to the load center (r)
Load is spherical with diameter=8mm
Number of loads=6
Distance from load centre to the table centre=50mm
Inertia of the cylindrical load on the table: Jl/t = (phi/20)*pho*D^5 + (phi/6)*pho*D^3*r^2 =3.17*10^-5 kgm^2
Total load inertia: $JL = Jt + Js + Jl$/t =4.77*10^-4 kgm^2
: Determine the torque
• Determine the acceleration torque (ignore the rotor inertia)
• The load torque :
Acceleration torque in N-m:
$Ta = JL \times V$ /9.55 × ta =1.374*10^-5 N-m
• ta - acceleration/deceleration time (typically 1 – 2 seconds)
: Load torque in N-m:
$TL = ml/t \times g/\ \eta \times 1$ =0.1178 N-m
$T = (Ta+TL) \times FO$S=0.650N-m

Size a motor to move a load linearly using a screwnut mechanism
Motor provided=12v
Motor specification:
Max speed=30 rpm and max torque=3N-m
Determine the load (m) on the table (in kg)=volume of all material*density of material used.
Volume of material=1.18*10^-3 m^3
Density=7850kg/m^3
Mass =9.43 kg
Screw calculation:
Diameter=42.5mm
Length=260mm
Pitch=282.5mm
Estimate the load inertia
$JL = Jt + Js = (pb/ 2\pi)^ 2 + (\pi /32) \varrho\, l\, d^4 = 0.2kgm^2$
Acceleration torque in N-m:
$Ta = JL \times V /9.55 \times t =0.628n\text{-}m$
Load torque in N-m:
As there an no external force FA opposing the motion
Hence the load torque is negligible.
$T = (Ta+TL) \times FOS =1.3N\text{-}m$

Water Pump and Sensor Arduino Code

```
#include <DHT.h>

#define DHTPIN 2  // Digital pin connected to the DHT sensor
#define DHTTYPE DHT11  // DHT 11 sensor type

#define RELAY_PIN 3 // Digital pin connected to the relay module

DHT dht(DHTPIN, DHTTYPE);

void setup() {
 Serial.begin(9600);
 pinMode(RELAY_PIN, OUTPUT);
 dht.begin();
}

void loop() {
 delay(10000);  // Delay between sensor readings

 float temperature = dht.readTemperature(); // Read temperature from DHT sensor
 float humidity = dht.readHumidity(); // Read humidity from DHT sensor

 if (isnan(temperature) || isnan(humidity)) { // Check if any reading failed
  Serial.println("Failed to read from DHT sensor!");
  return;
 }

 Serial.print("Temperature: ");
 Serial.print(temperature);
 Serial.print(" °C\t");

 Serial.print("Humidity: ");
 Serial.print(humidity);
 Serial.println(" %");

 // Check if temperature is above a certain threshold
 if (temperature > 25) {
  digitalWrite(RELAY_PIN, LOW); // Turn on the water pump
  Serial.println("Water pump turned ON.");
 } else {
  digitalWrite(RELAY_PIN, HIGH); // Turn off the water pump
  Serial.println("Water pump turned OFF.");
 }
}
```

Motor Driving Arduino Code

```
#define BRAKE 0
#define CW 1
#define CCW 2
#define CS_THRESHOLD 15 // Definition of safety current (Check: "1.3 Monster Shield Example").

// MOTOR 1
#define MOTOR_A1_PIN 7
#define MOTOR_B1_PIN 8

// MOTOR 2
#define MOTOR_A2_PIN 4
#define MOTOR_B2_PIN 9

#define PWM_MOTOR_1 5
#define PWM_MOTOR_2 6

#define CURRENT_SEN_1 A2
#define CURRENT_SEN_2 A3

#define EN_PIN_1 A0
#define EN_PIN_2 A1

#define MOTOR_1 0
#define MOTOR_2 1

#define SPEED_WHEEL = 60
#define SPEED_SEED = 60

short usSpeed = 150; // default motor speed
unsigned short usMotor_Status = BRAKE;

void setup()
{
  pinMode(MOTOR_A1_PIN, OUTPUT);
  pinMode(MOTOR_B1_PIN, OUTPUT);

  pinMode(MOTOR_A2_PIN, OUTPUT);
  pinMode(MOTOR_B2_PIN, OUTPUT);

  pinMode(PWM_MOTOR_1, OUTPUT);
  pinMode(PWM_MOTOR_2, OUTPUT);
```

```
 pinMode(CURRENT_SEN_1, OUTPUT);
 pinMode(CURRENT_SEN_2, OUTPUT);

 pinMode(EN_PIN_1, OUTPUT);
 pinMode(EN_PIN_2, OUTPUT);

 Serial.begin(9600); // Initiates the serial to do the monitoring
 Serial.println("Begin motor control");
 Serial.println(); // Print function list for user selection
 Serial.println("Enter number for control option:");
 Serial.println("1. STOP");
 Serial.println("2. FORWARD");
 Serial.println("3. REVERSE");
 Serial.println("4. READ CURRENT");
 Serial.println("+. INCREASE SPEED");
 Serial.println("-. DECREASE SPEED");
 Serial.println();
}

void loop()
{
 char user_input;

 while (Serial.available())
 {
 user_input = Serial.read(); // Read user input and trigger the appropriate function
 digitalWrite(EN_PIN_1, HIGH);
 digitalWrite(EN_PIN_2, HIGH);

 if (user_input == '1')
 {
 Stop();
 }
 else if (user_input == '2')
 {
 Forward();
 }
 else if (user_input == '3')
 {
 Reverse();
 }
 else if (user_input == '+')
 {
 IncreaseSpeed();
 }
 else if (user_input == '-')
 {
 DecreaseSpeed();
 }
 else
 {
 Serial.println("Invalid option entered.");
 }
 }
}
```

```
void Stop()
{
 Serial.println("Stop");
 usMotor_Status = BRAKE;
 motorGo(MOTOR_1, usMotor_Status, 0);
 motorGo(MOTOR_2, usMotor_Status, 0);
}

void Forward()
{
 Serial.println("Forward");
 usMotor_Status = CW;
 motorGo(MOTOR_1, usMotor_Status, usSpeed);
 motorGo(MOTOR_2, usMotor_Status, usSpeed);
}

void Reverse()
{
 Serial.println("Reverse");
 usMotor_Status = CCW;
 motorGo(MOTOR_1, usMotor_Status, usSpeed);
 motorGo(MOTOR_2, usMotor_Status, usSpeed);
}

void IncreaseSpeed()
{
 usSpeed = usSpeed + 10;
 if (usSpeed > 255)
 {
 usSpeed = 255;
 }

 Serial.print("Speed +: ");
 Serial.println(usSpeed);

 motorGo(MOTOR_1, usMotor_Status, usSpeed);
 motorGo(MOTOR_2, usMotor_Status, usSpeed);
}

void DecreaseSpeed()
{
 usSpeed = usSpeed - 10;
 if (usSpeed < 0)
 {
 usSpeed = 0;
 }

 Serial.print("Speed -: ");
 Serial.println(usSpeed);

 motorGo(MOTOR_1, usMotor_Status, usSpeed);
 motorGo(MOTOR_2, usMotor_Status, usSpeed);
}
```

```
void motorGo(uint8_t motor, uint8_t direct, uint8_t pwm)
{
 if (motor == MOTOR_1)
 {
 if (direct == CW)
 {
 digitalWrite(MOTOR_A1_PIN, LOW);
 digitalWrite(MOTOR_B1_PIN, HIGH);
 }
 else if (direct == CCW)
 {
 digitalWrite(MOTOR_A1_PIN, HIGH);
 digitalWrite(MOTOR_B1_PIN, LOW);
 }
 else
 {
 digitalWrite(MOTOR_A1_PIN, LOW);
 digitalWrite(MOTOR_B1_PIN, LOW);
 }

 analogWrite(PWM_MOTOR_1, pwm);
 }
 else if (motor == MOTOR_2)
 {
 if (direct == CW)
 {
 digitalWrite(MOTOR_A2_PIN, LOW);
 digitalWrite(MOTOR_B2_PIN, HIGH);
 }
 else if (direct == CCW)
 {
 digitalWrite(MOTOR_A2_PIN, HIGH);
 digitalWrite(MOTOR_B2_PIN, LOW);
 }
 else
 {
 digitalWrite(MOTOR_A2_PIN, LOW);
 digitalWrite(MOTOR_B2_PIN, LOW);
 }

 analogWrite(PWM_MOTOR_2, pwm);
 }
}
```

Cost Analysis

Material: Steel

Cost: 100Rs/kg

Total weight of the Steel used= 9.5kg

Total cost of steel used= 950Rs

Cost of Electric kit= 1000Rs

Cost of additional motor used= 1300Rs

Cost of sensor and water pump= 300Rs

Process	Price (Rs./hr.)	Total Hours	Total Cost
Drilling	75	1.5	112.5
Milling	250	3	750
Turning	150	8	1200
3D Printing	100	2	200

Labour Cost= 650/day (8 hours)

Total working time= 20hour

Number of team members= 8

Total Labour Cost= 13000Rs

Total Cost= 18812.5Rs

Conclusion

The seed sowing machine stands as a pivotal innovation in modern agriculture, addressing key challenges in the planting process while significantly enhancing efficiency and productivity. Its importance lies in its ability to automate the labor-intensive task of sowing seeds, thereby reducing manual labor requirements, increasing precision, and optimising resource utilisation. The combination of seed sorting with automated sowing technology holds immense promise for revolutionising farming practices,enabling farmers to achieve higher yields with greater reliability and sustainability. The insights gained from this project serve as a foundation for further innovation in agricultural automation, paving the way for a more productive and resilient future in farming