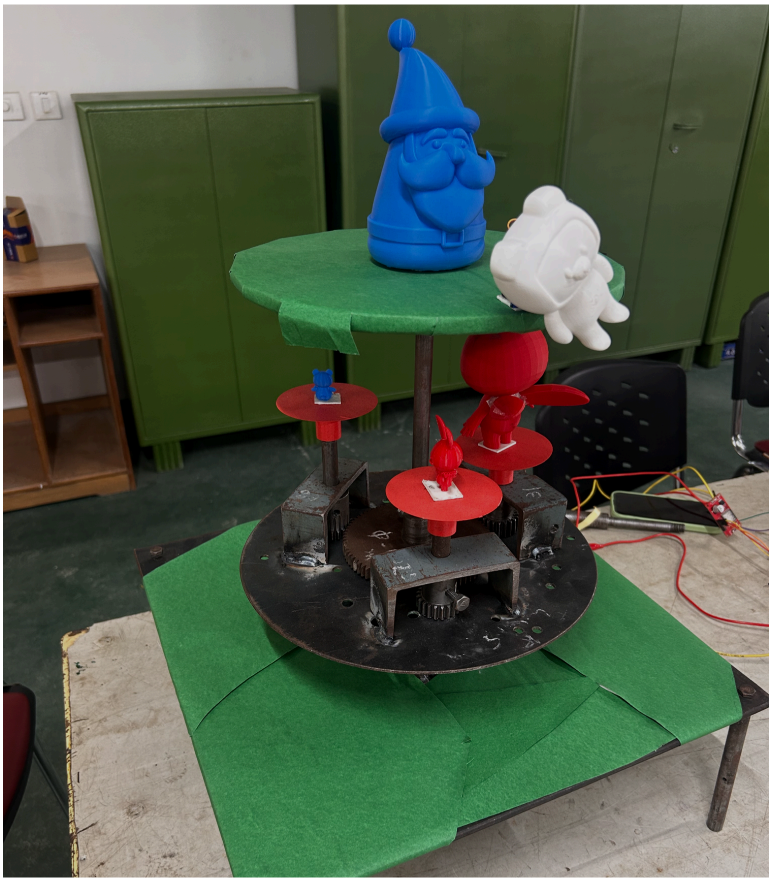
TA 212 (Manufacturing Processes II)

MERRY GO ROUND

Group 1



Instructor - Prof Arvind Kumar

Guide - Mr. Rakesh Thapliyal

Chaitanya Goel
230314

Chaudhary Krishna Prakash
230326

Chhavi Tanwar
230329

Chandra Bhan
230320

Shiva Teja
230610

Malavika Nair
230622

Table of Contents

Part List

Part Name	Quantity	Type of Material Required	Dimension (in mm)	Material	Machining processes used	Page No.
Square Plate	1	Flat	417*417*8.24	Mild steel	Drilling	11
Circular Plate Holder	1	Flat	99*89 *54	Mild Steel	Cutting, Bending	12
Circular Plate collar	1	Flat	φ110 *φ30*31	Mild Steel	Drilling	13
Circular Plate	1	Sheet	φ284.64 *2	Mild Steel	Drilling	14
Spur gear(big)	1	Rod	φ123	Mild Steel	Lathe, Milling	15
Spur gear(small)	1	Rod	φ34.5	Mild Steel	Lathe, Milling	16
revolving rod_1	1	Rod	12.7φ*78	Mild Steel	Lathe	17
Revolving rod holder	3	Flat	45*37* 98 7mm thick	Mild Steel	Drilling, Welding	18
Rotating central rod	1	Hollow Rod	12.7φ(inner), 21φ(outer)* 113.24	Mild Steel	Drilling, Lathe	19
Central rod(fixed)	1	Rod	12.7φ*340	Mild Steel	Lathe, Drilling	20
Wooden Plate holder	1	Flat	110φ*6 collar - 25*25	Mild Steel	Drilling	21

Circular Wooden Plate	1	Flat	255φ*9.3	Wood	Drilling	22
Bevel gear 1	1	Rod	21 teeth, 1.5 module, 31.662 φ, 28φ*20 (collar)	Mild Steel	Lathe, Milling, Drilling	23
Vertical Bevel Gear & Central rod holder	1	Flat	87*47*50 Thickness 6mm	Mild Steel	Drilling, Filing, Welding	24
Motor Rod	1	Rod	8(φ)*90	Mild Steel	Lathe	25
Horizontal Bevel Gear & Motor Holder 2	1	Rod	35*45*55 Thickness 6mm	Mild Steel	Welding, Filing	26
Horizontal Bevel Gear & Motor Holder	1	Flat	24*51*110 Thickness 6mm	Mild Steel	Welding, Drilling	27
Motor Holder	1	Flat	102*80*1.5	Mild Steel	Drilling	28
Bottom-most rod	1	Rod	12.7(φ)*154.24	Mild Steel	Lathe	29
Bevel Gear 2	1	Rod	21 teeth, 1.5 module, 31.662 φ, 24φ*20 (collar)	Mild Steel	Lathe, Milling, Drilling	30
Revolving Rod 2	1	Rod	12.7 (φ)*99.5	Mild Steel	Lathe	31
Revolving Rod 3	1	Rod	12.7(φ)*129	Mild steel	lathe	32
Saucer	3	-	80(φ)*10 Taper angle 60 degree Collar 20*20(φ)	Poly Lactic acid	3D print	33

Project Overview

In this project, we are building a fully functional working model of a real-life merry-go-round on a small scale. This project focuses on the design and development of a merry-go-round. The primary aim is to create a safe, durable, and aesthetically pleasing model. The merry-go-round will be powered electrically and controlled using Arduino and motor controllers.

PROJECT OBJECTIVES

Concept Development: Sketch initial designs, calculate mechanical loads and select materials.

Design: Use CAD software to create detailed blueprints and simulate performance.

Fabrication: Procure materials and assemble the merry-go-round structure and mechanism.

Educational Application:
A tangible demonstration of engineering principles, such as rotational mechanics, load distribution, and energy conversion.

Acknowledgement

We would like to sincerely thank our project guide, **Mr. Rakesh Thapliyal**, for his constant support and encouragement throughout the course of this project. His valuable guidance, insightful suggestions, and patient teaching of key concepts in mechanics and design played a crucial role in shaping our understanding and helping us overcome various technical challenges. This project would not have been possible without his mentorship and enthusiasm for hands-on learning..

Abstract

This project presents the design and fabrication of a mechanical merry-go-round integrated with a dancing doll, combining both mechanical and electronic systems. The merry-go-round is powered by a DC motor, providing continuous rotational motion, while the dancing doll is animated using a servo motor programmed to execute rhythmic movements. The system showcases the integration of basic mechanical components—such as gears and linkages—with electronic control elements to achieve synchronized motion. The goal is to demonstrate motion transmission, control, and coordination between multiple subsystems in a compact and interactive setup. This project encapsulates the interdisciplinary learning outcomes of TA212, blending mechanical design with introductory electronics and control systems.

Motivation

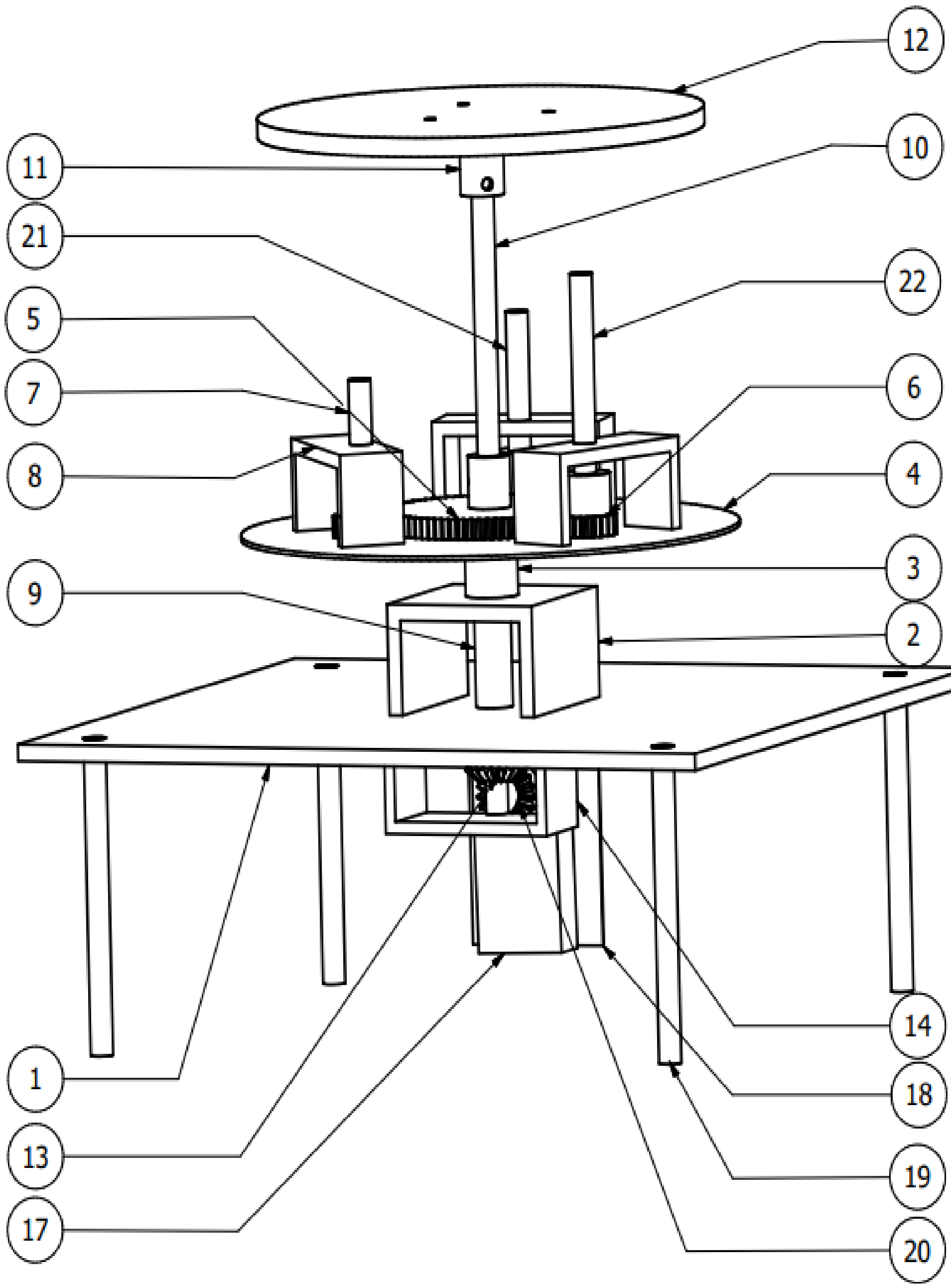
We chose to make a mechanical merry-go-round with a dancing doll because we wanted to build something fun, creative, and interactive using both mechanical and electronic concepts. The idea gave us a chance to apply what we learned in class—like how to make gears, 3D print items, and how linkages work etc—in a hands-on project. We also wanted to challenge ourselves by combining motion in two different parts: the rotating platform and the moving doll. Overall, our goal was to create something engaging that shows how simple engineering ideas can be used to bring motion and life to everyday objects.

Motor Sizing

For rotating the merry-go-round platform, we used a **12V DC square gear motor** with a **rated speed of 30 RPM** and **torque of 13 kg-cm**. The motor was selected based on the following considerations:

- **Speed Requirement:**
  We wanted the merry-go-round to rotate at a slow and visually appealing speed. A motor with 30 RPM was ideal, as it provided smooth and gentle rotation suitable for the toy-like nature of the setup.
- **Torque Requirement:**
  The platform, along with the mounted doll and other components, has a moderate weight. We estimated the required torque to be under 10 kg-cm, considering the platform radius and load. The chosen motor provides **13 kg-cm of torque**, which is sufficient to rotate the structure smoothly without stalling.
- **Voltage Compatibility:**
  The motor operates at **12V**, which is easily supported using a battery pack or a DC power supply, making it convenient for both portability and demonstration.

Hence, the selected motor met our requirements in terms of speed, torque, and ease of integration, ensuring reliable performance for our merry-go-round mechanism.



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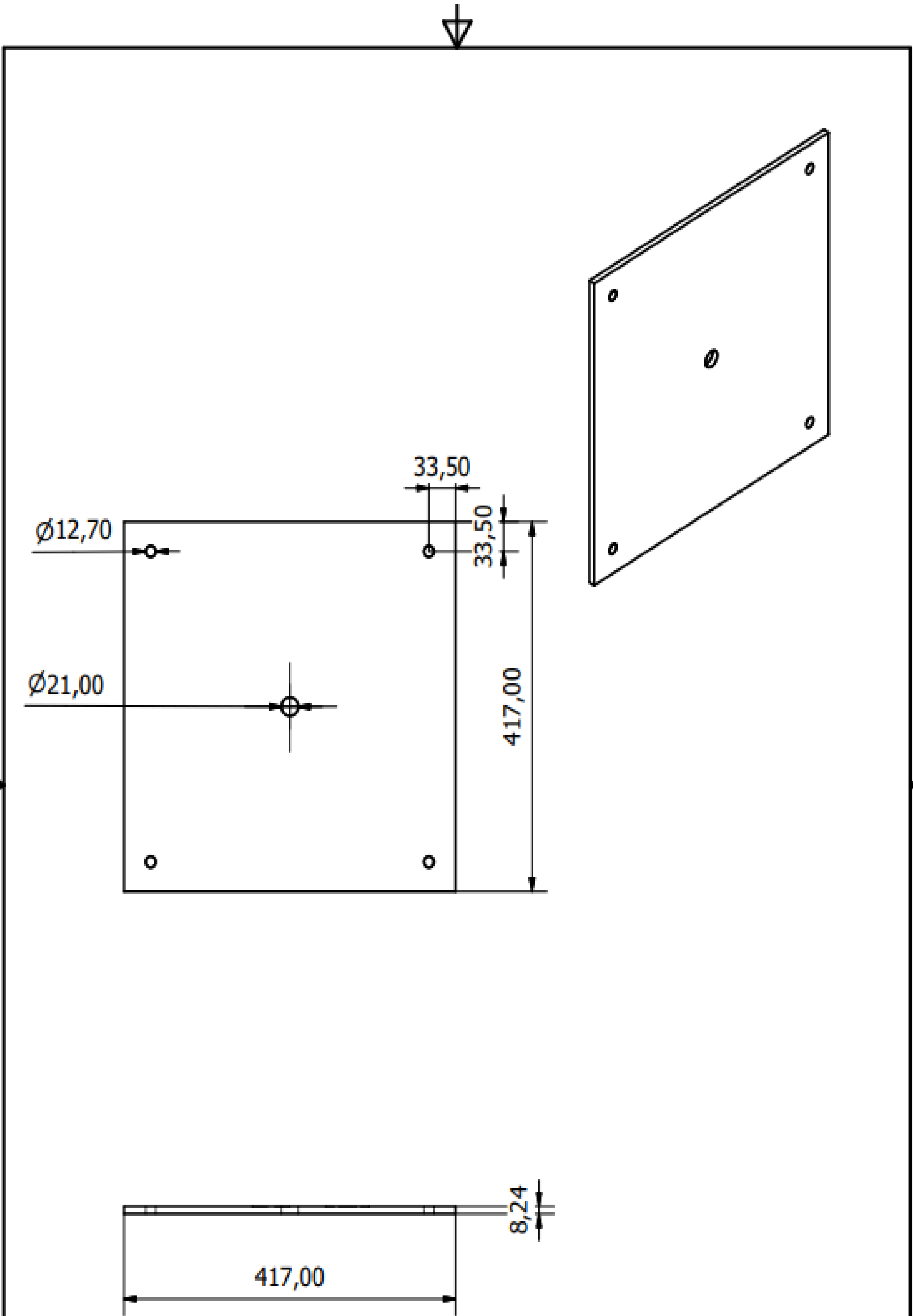
shiva					11-04-2025	

MerryGoRound



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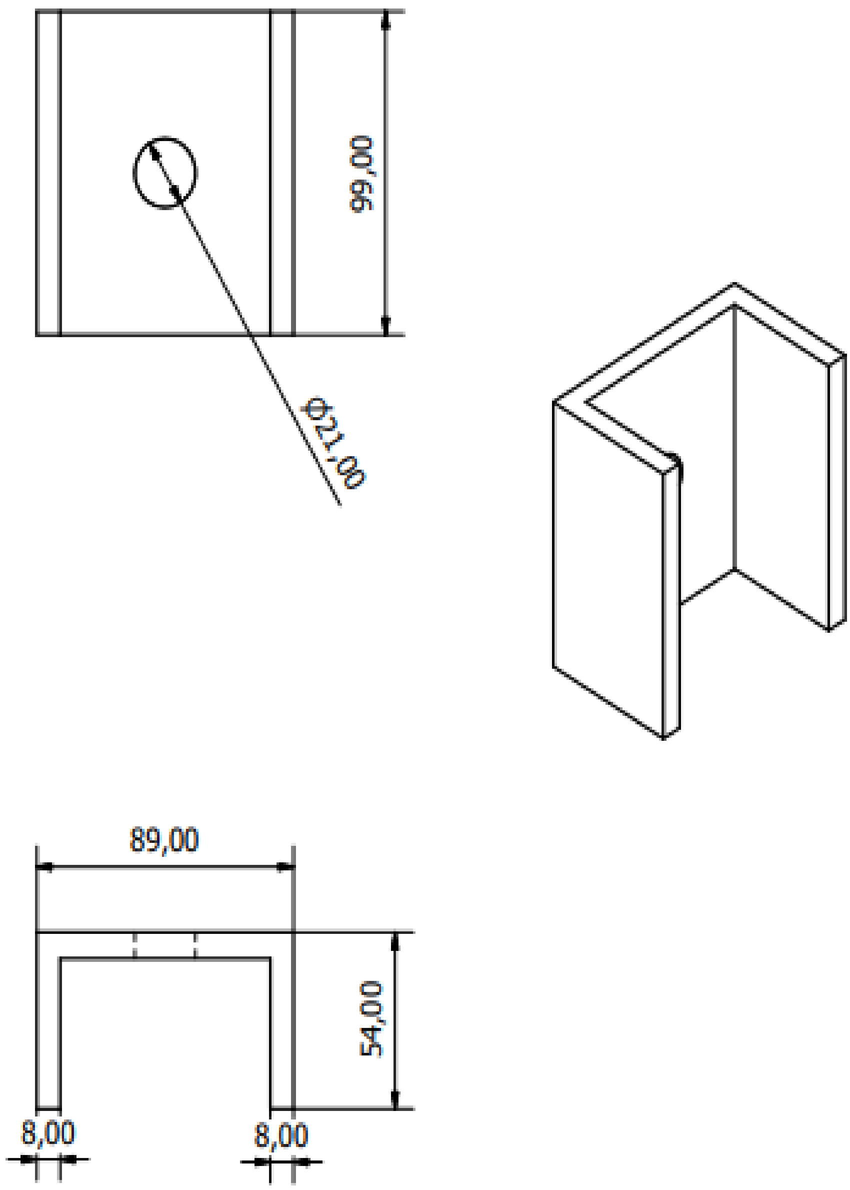
	Square plate				Edition	Sheet 1



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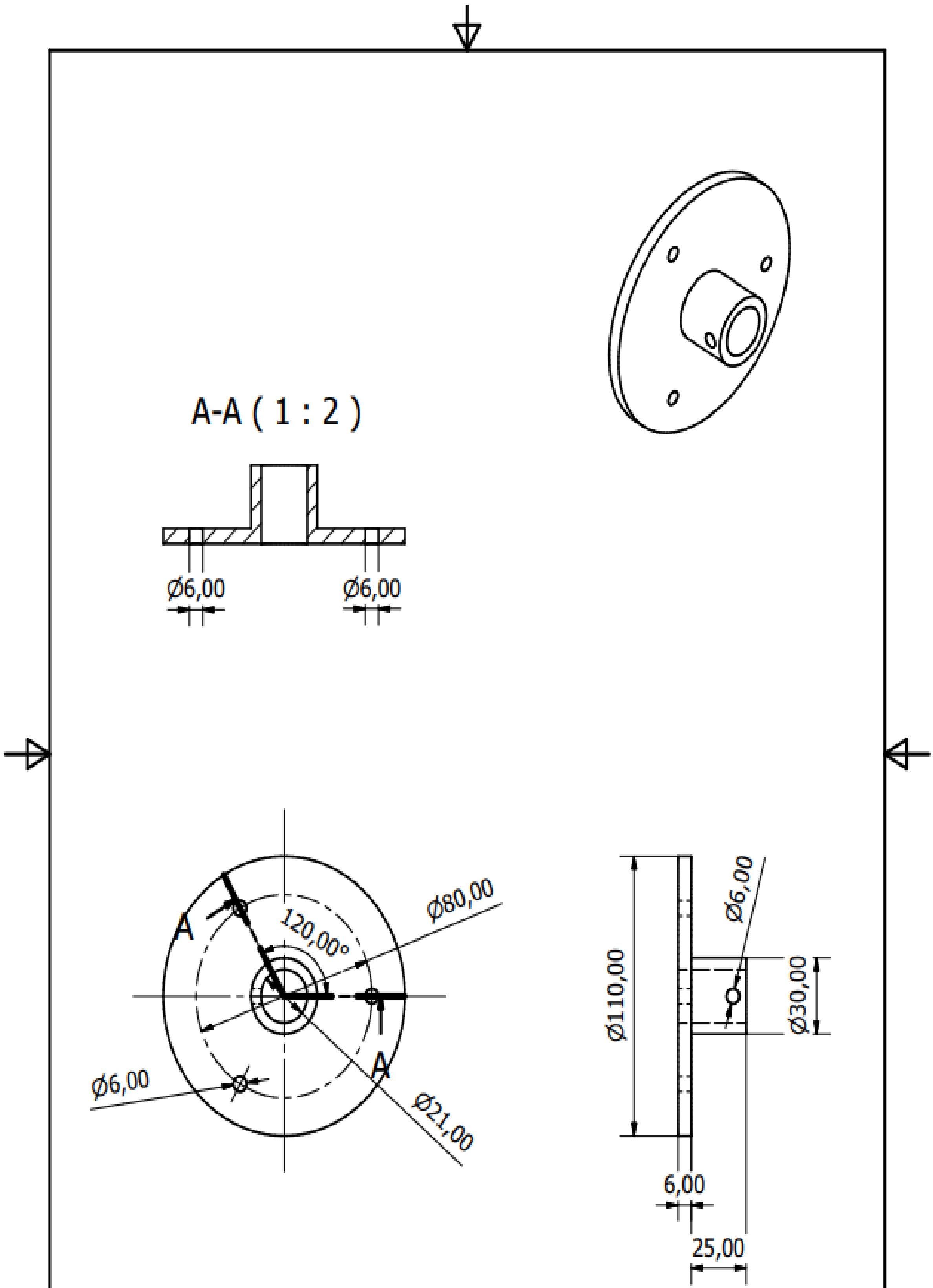
			Circular plate(below) holder		Edition	Sheet 2



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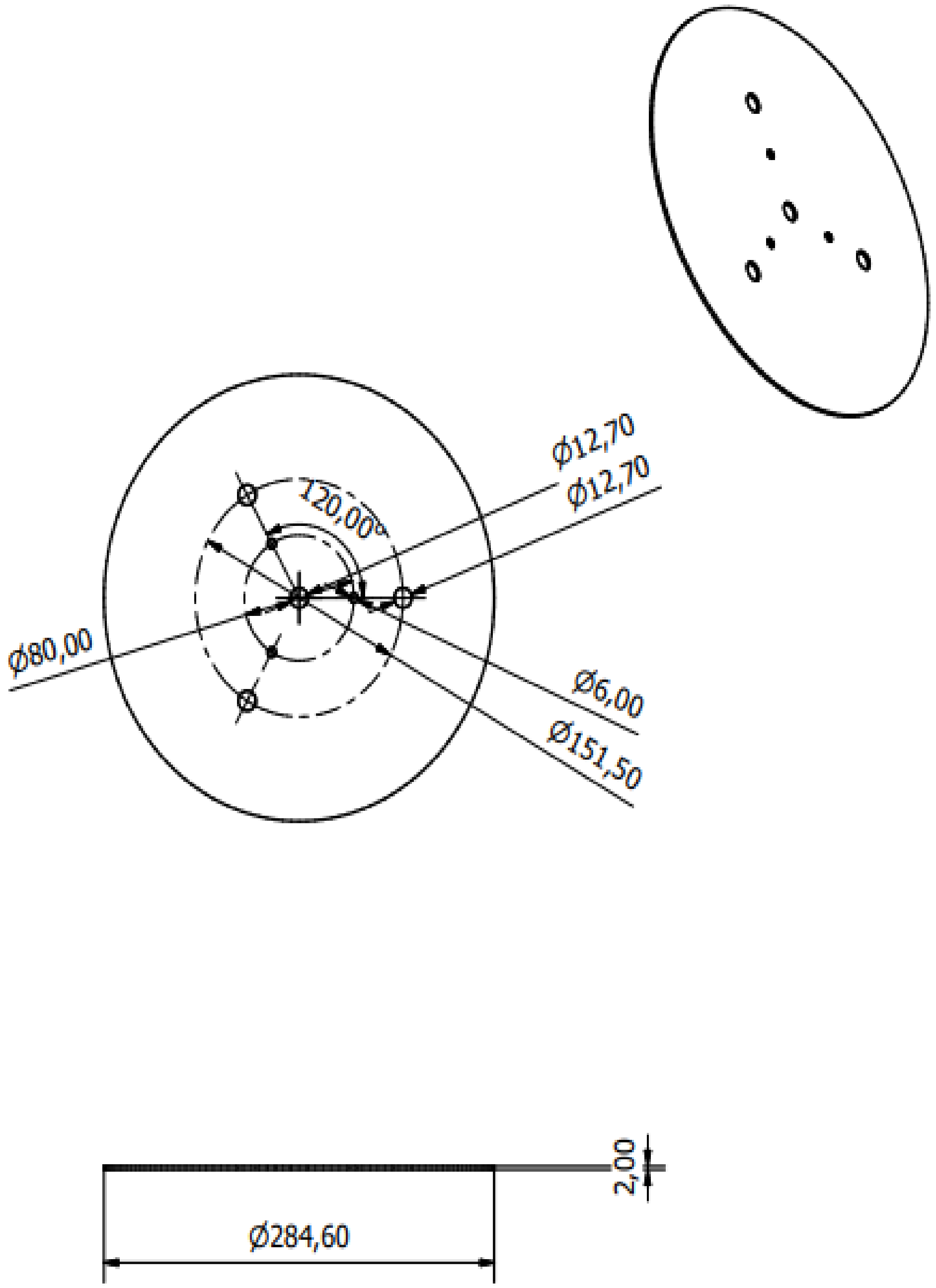

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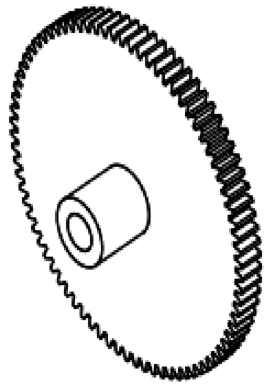
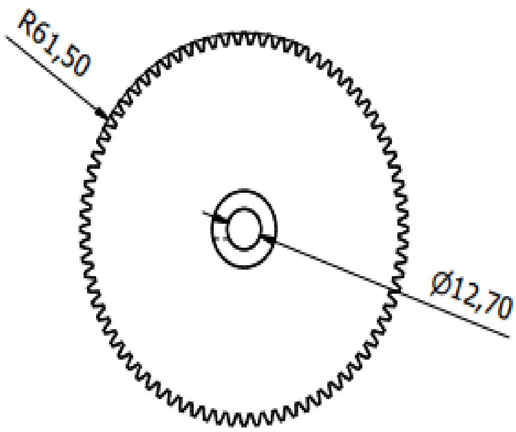
	Circular plate(below)	Edition	Sheet 4





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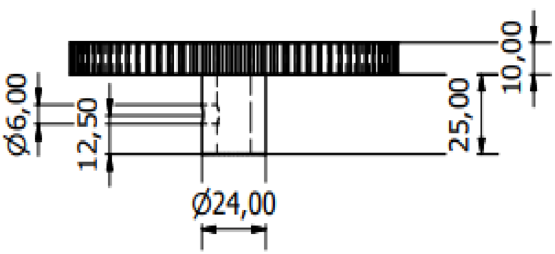
diameter = 123

module = 1.5



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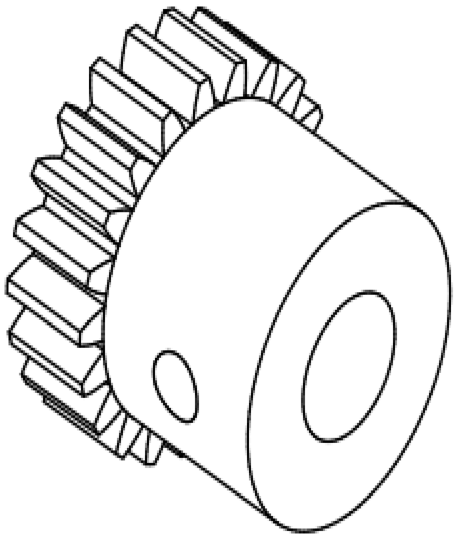
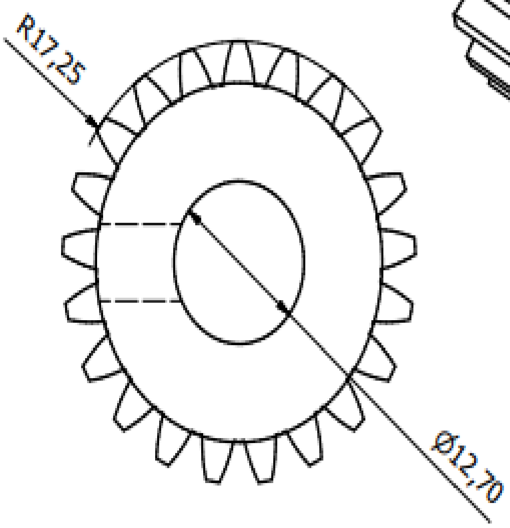
	Spur Gear(Big)			Edition	Sheet 5





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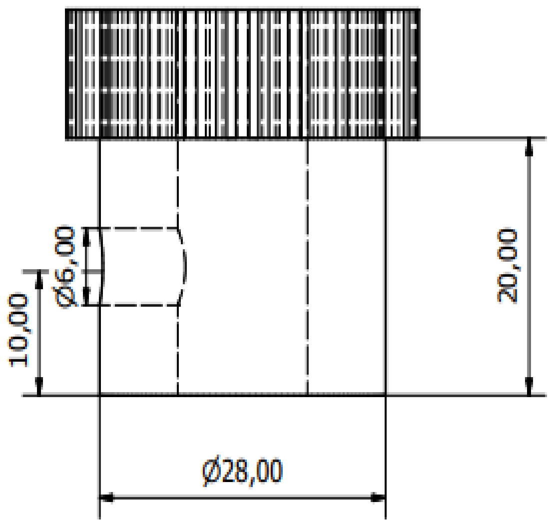
diameter = 34.5

module = 1.5



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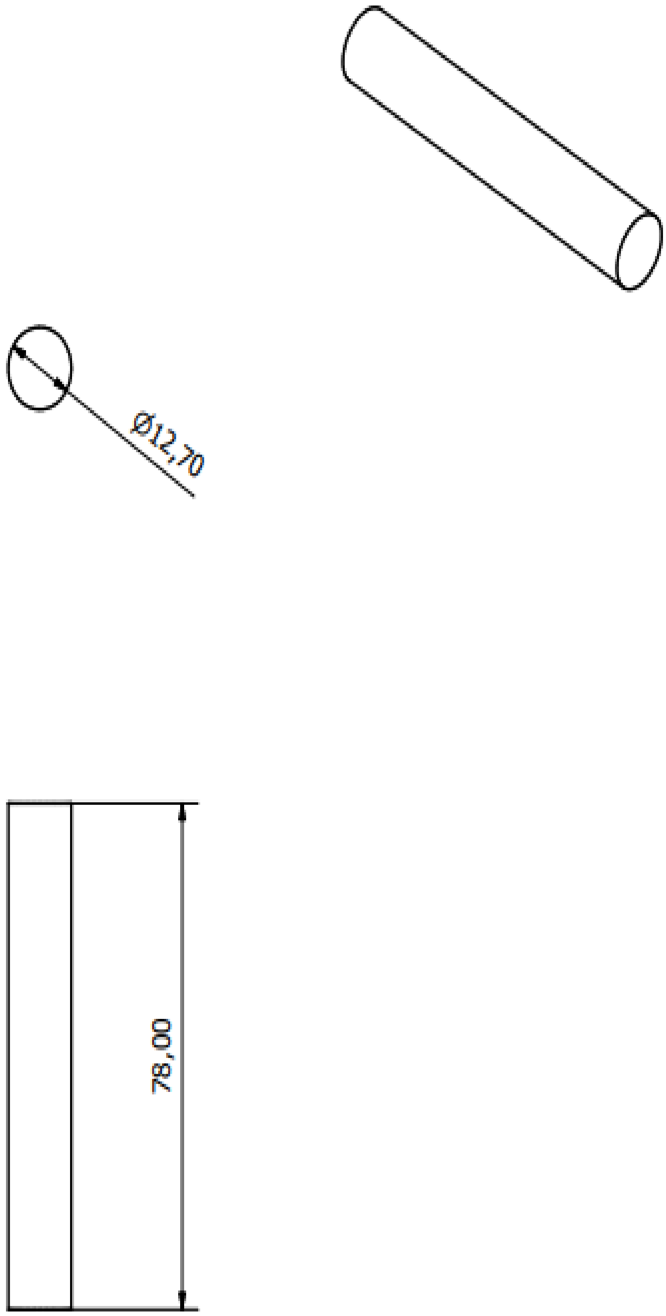
		Spur Gear (small)			Edition	Sheet 6



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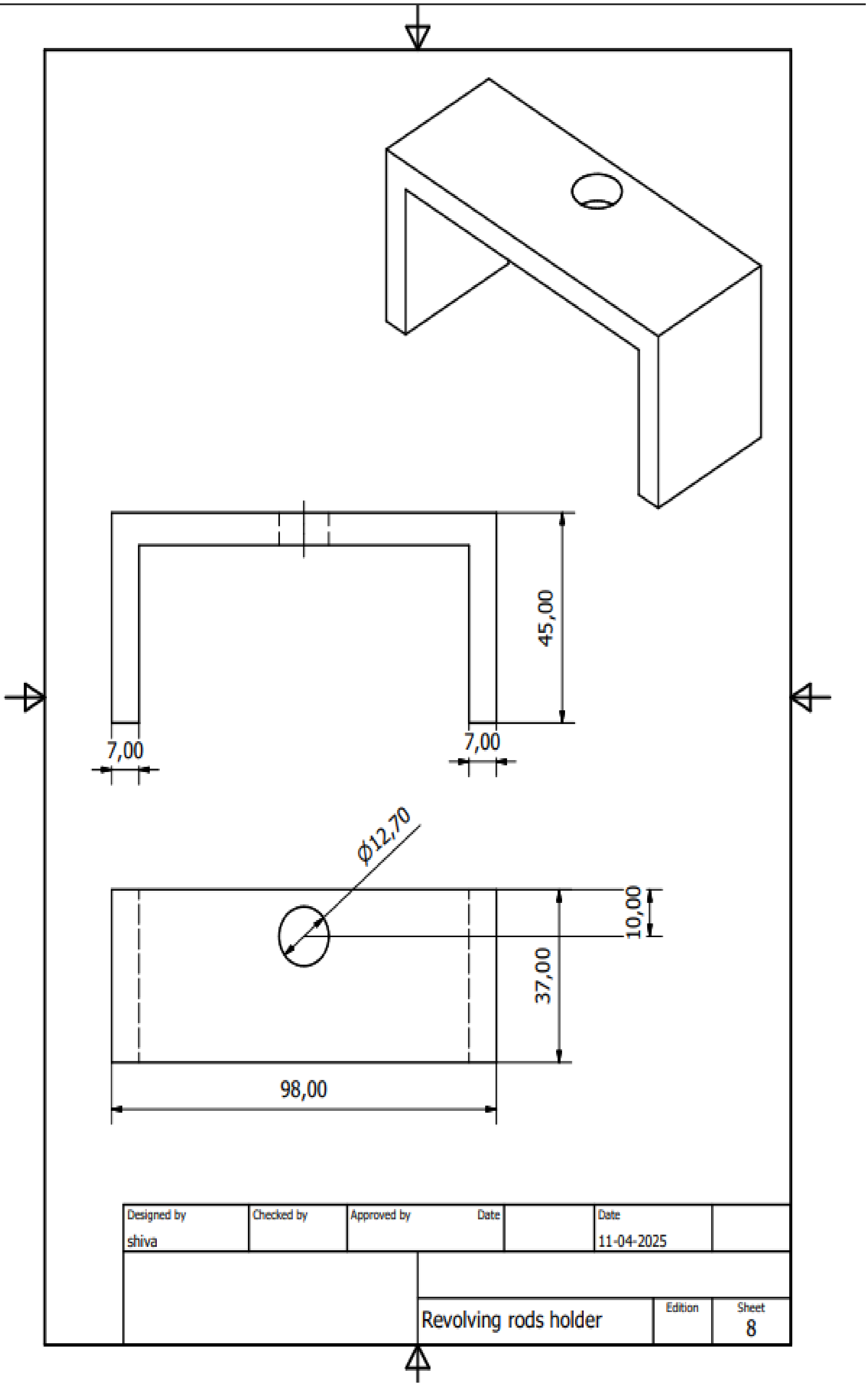
	Revolving rod _1				Edition	Sheet 7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Date
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11-04-2025
Revolving rods holder
Edition
Sheet
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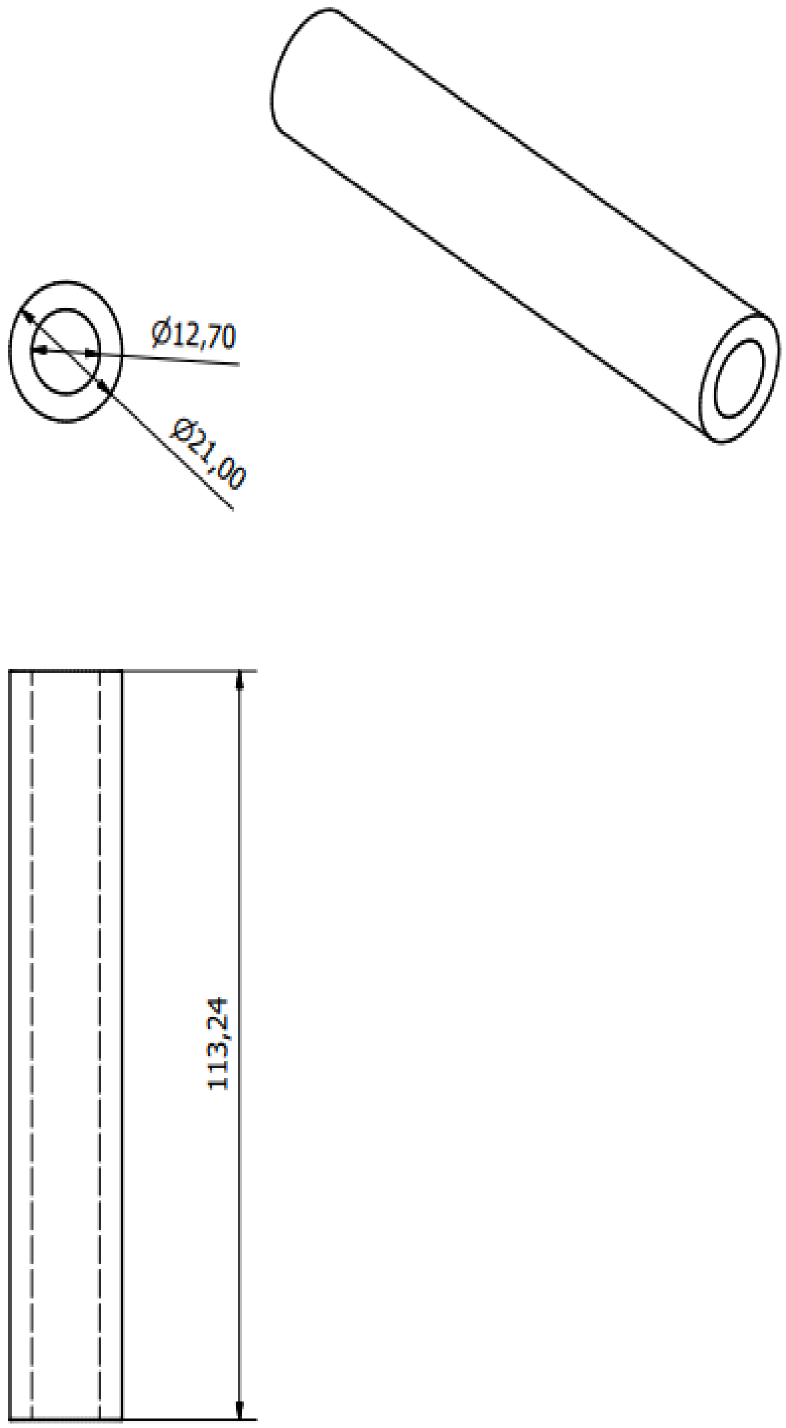

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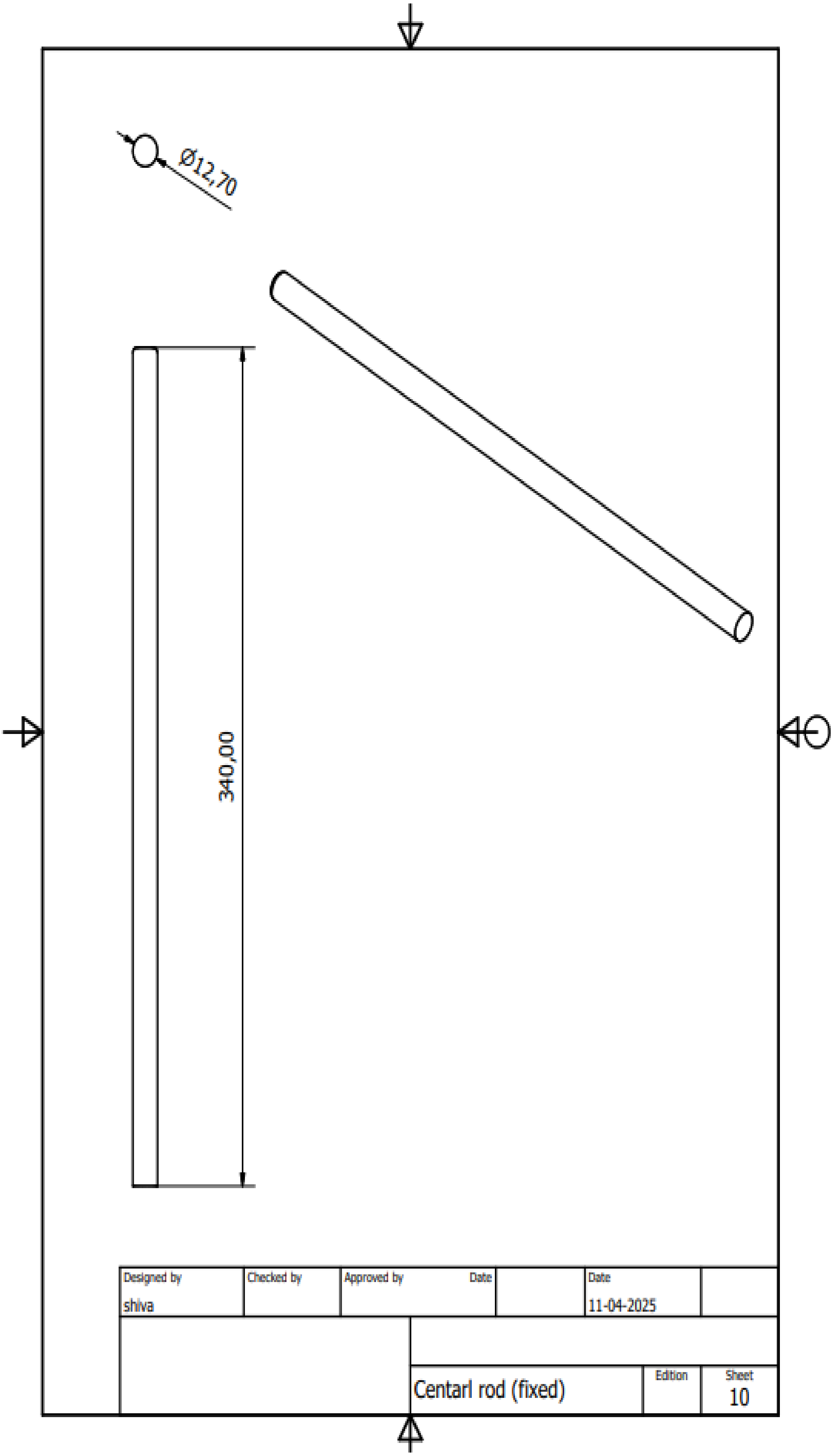
	Rotating central rod	Edition	Sheet 9



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11-04-2025
Centarl rod (fixed)
Edition
Sheet
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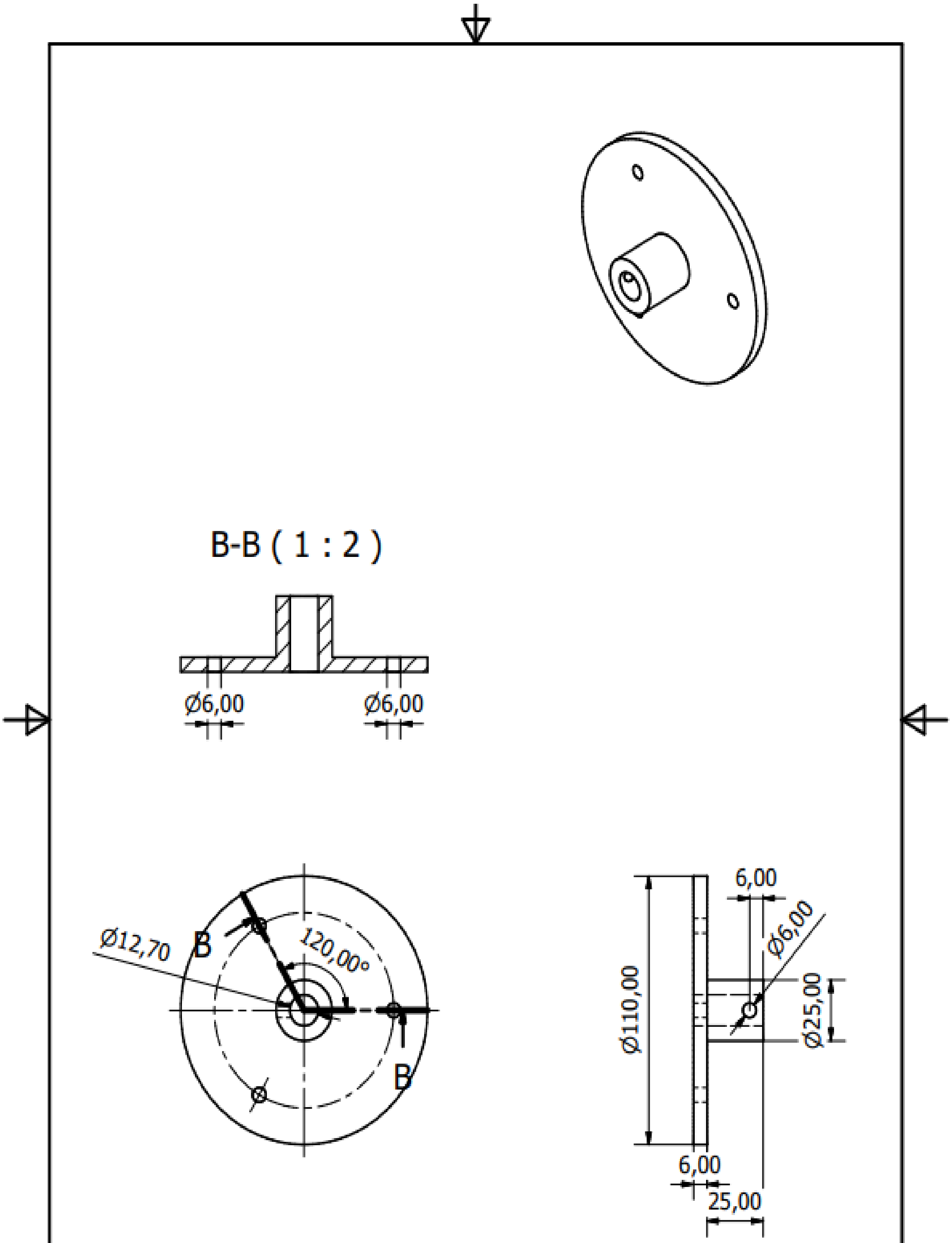

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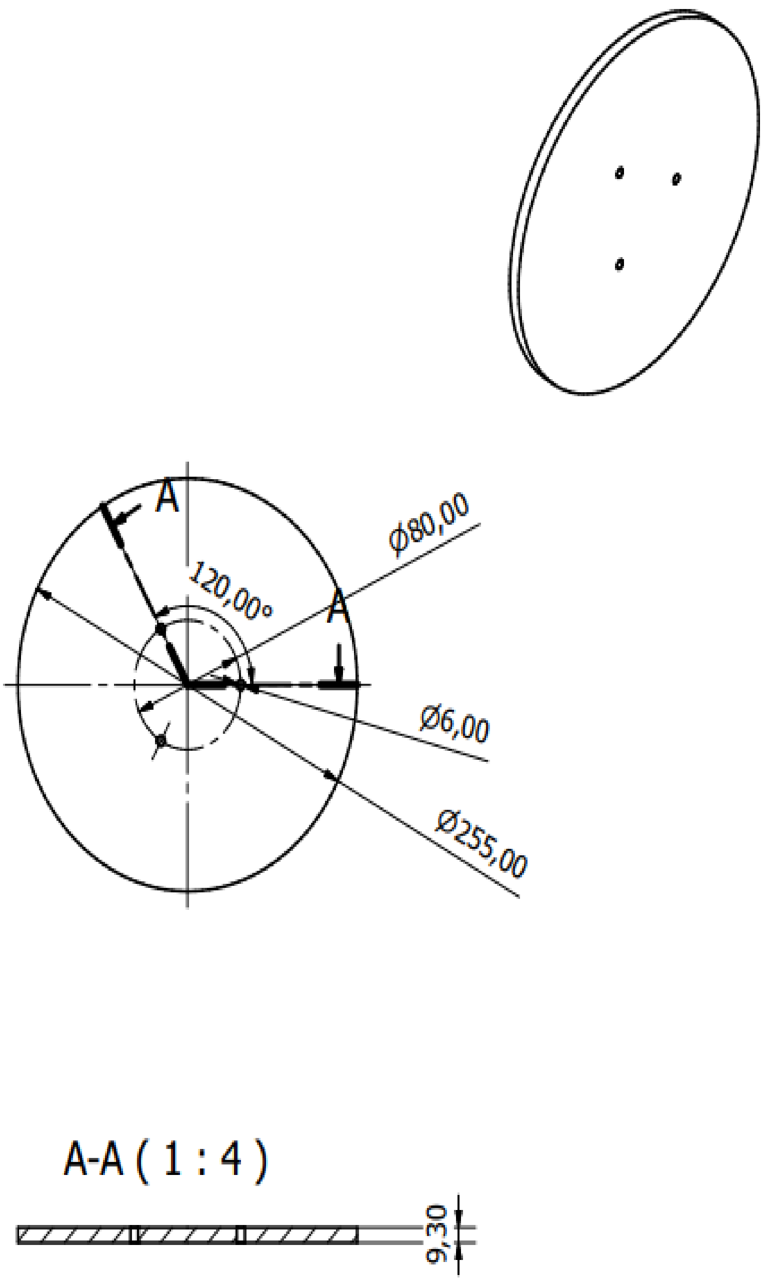
	Edition	Sheet
Wooden plate holder		11



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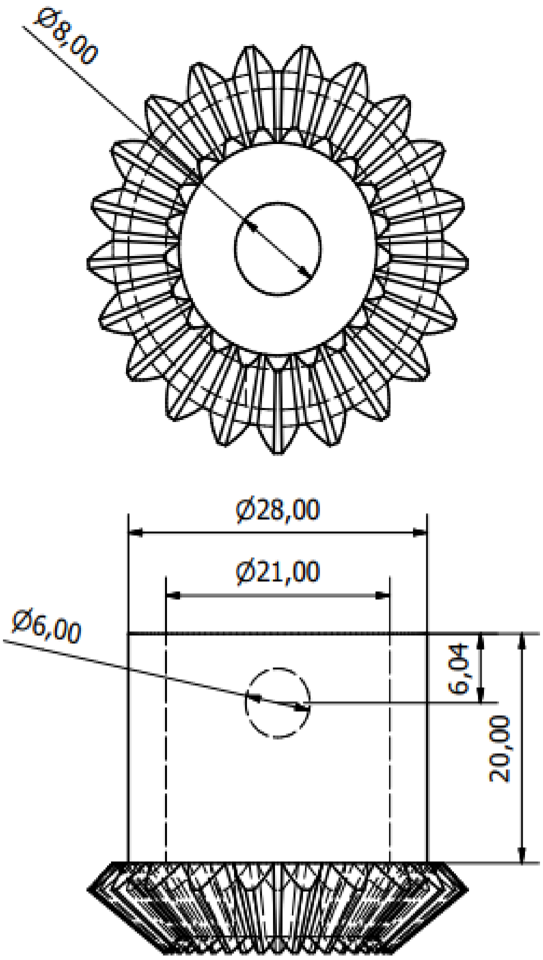
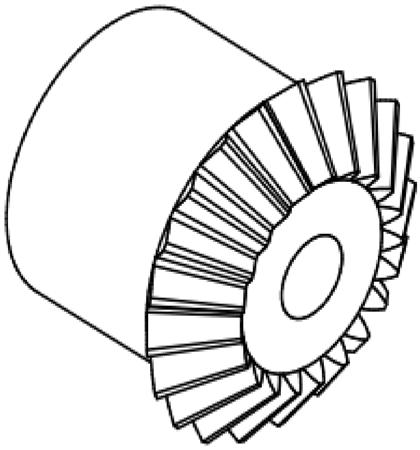
Wooden circular plate				Edition	Sheet 12





no. of teeth = 21

Diameter = 31.662

module = 1.5

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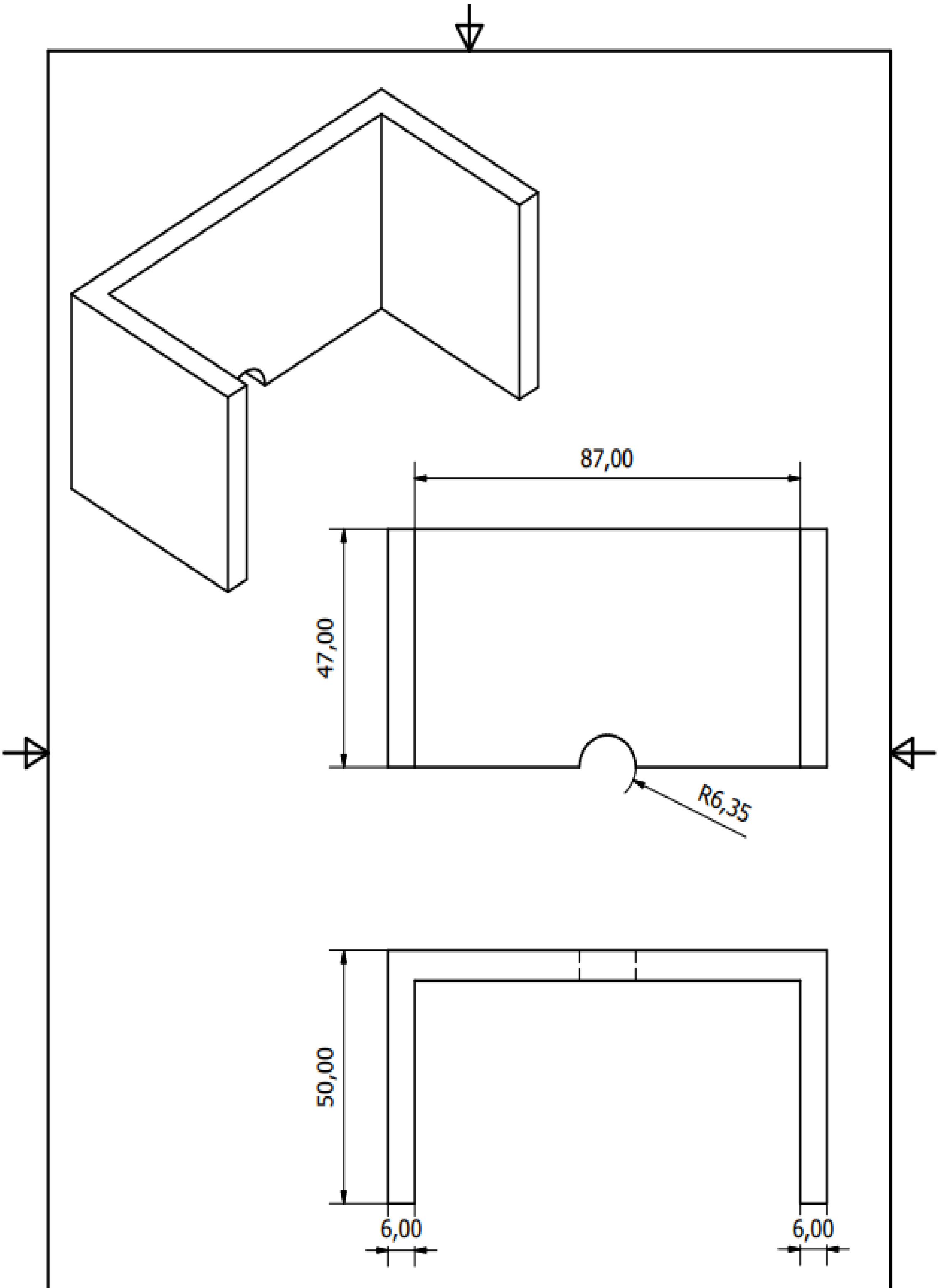
	Bevel Gear1			Edition	Sheet 13



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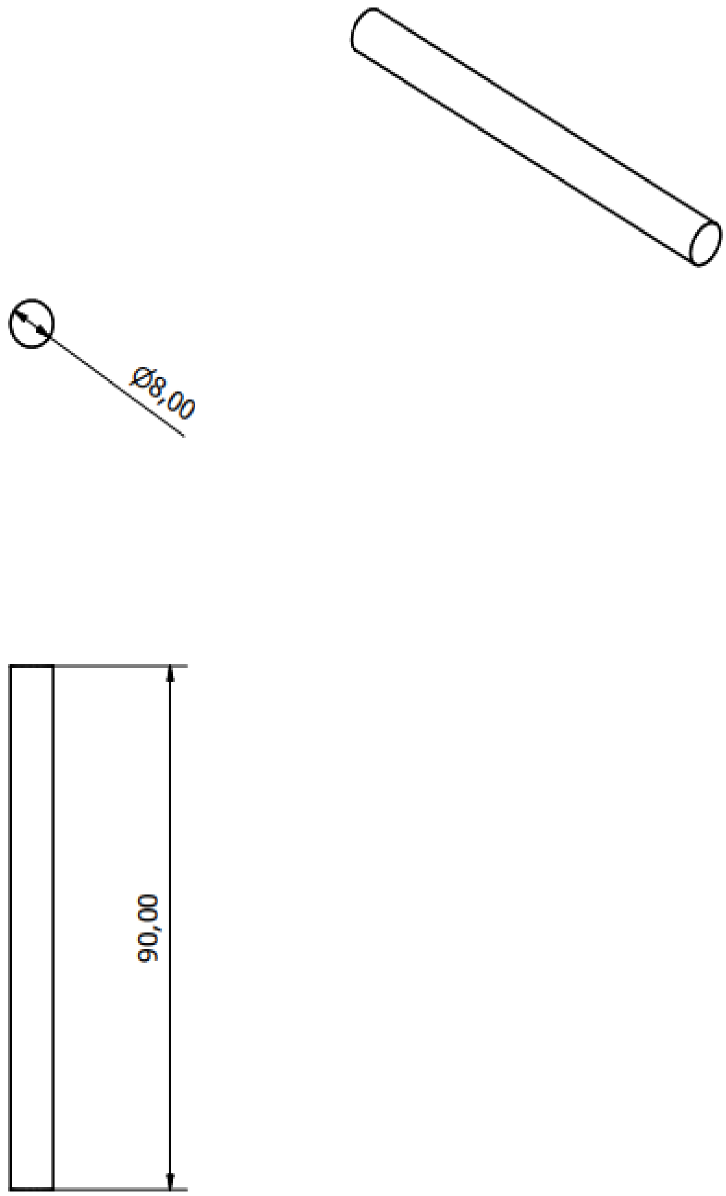
	Vertical Bevel Gear&central rod holder				Sheet 14



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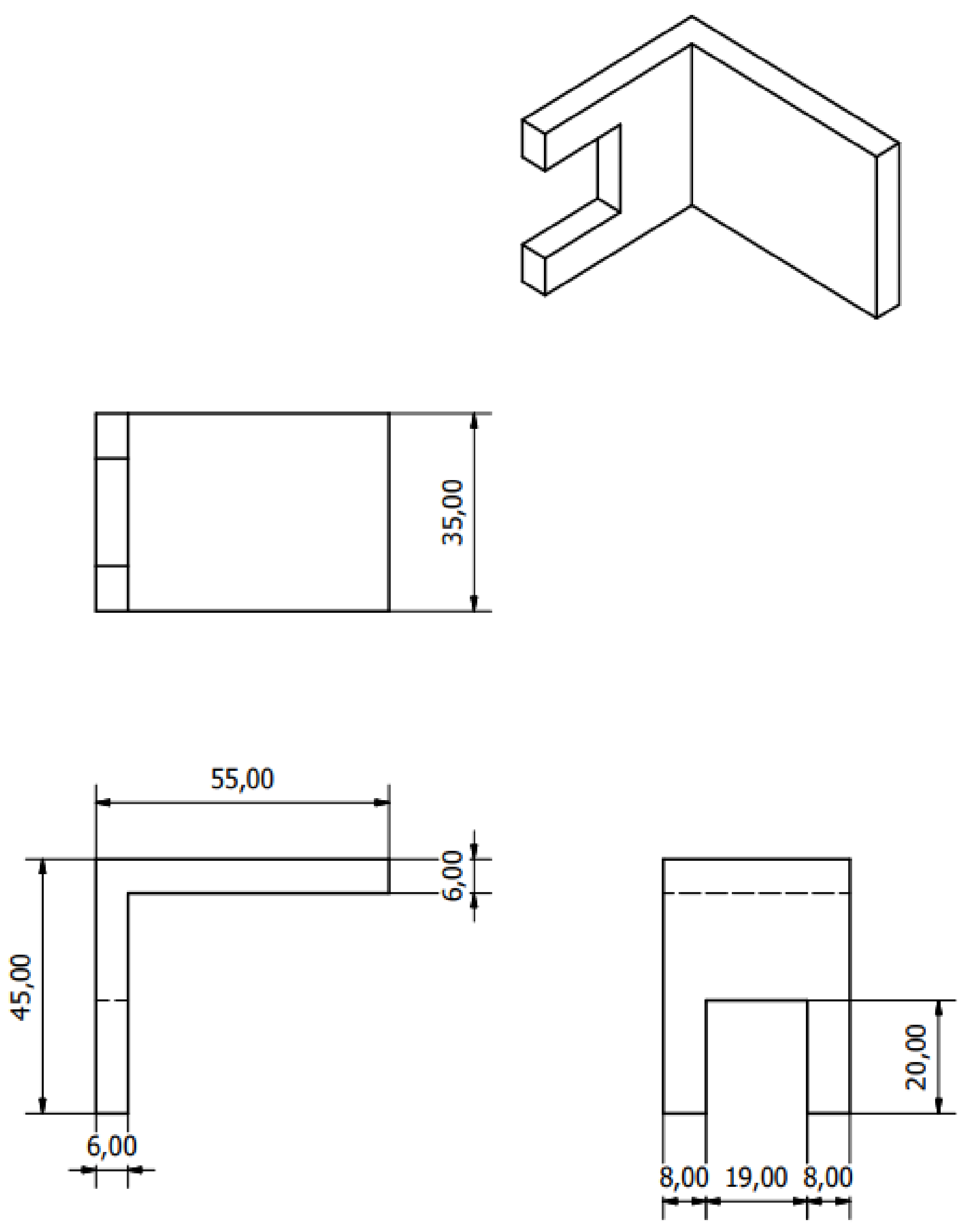
		motor rod		Edition	Sheet 15



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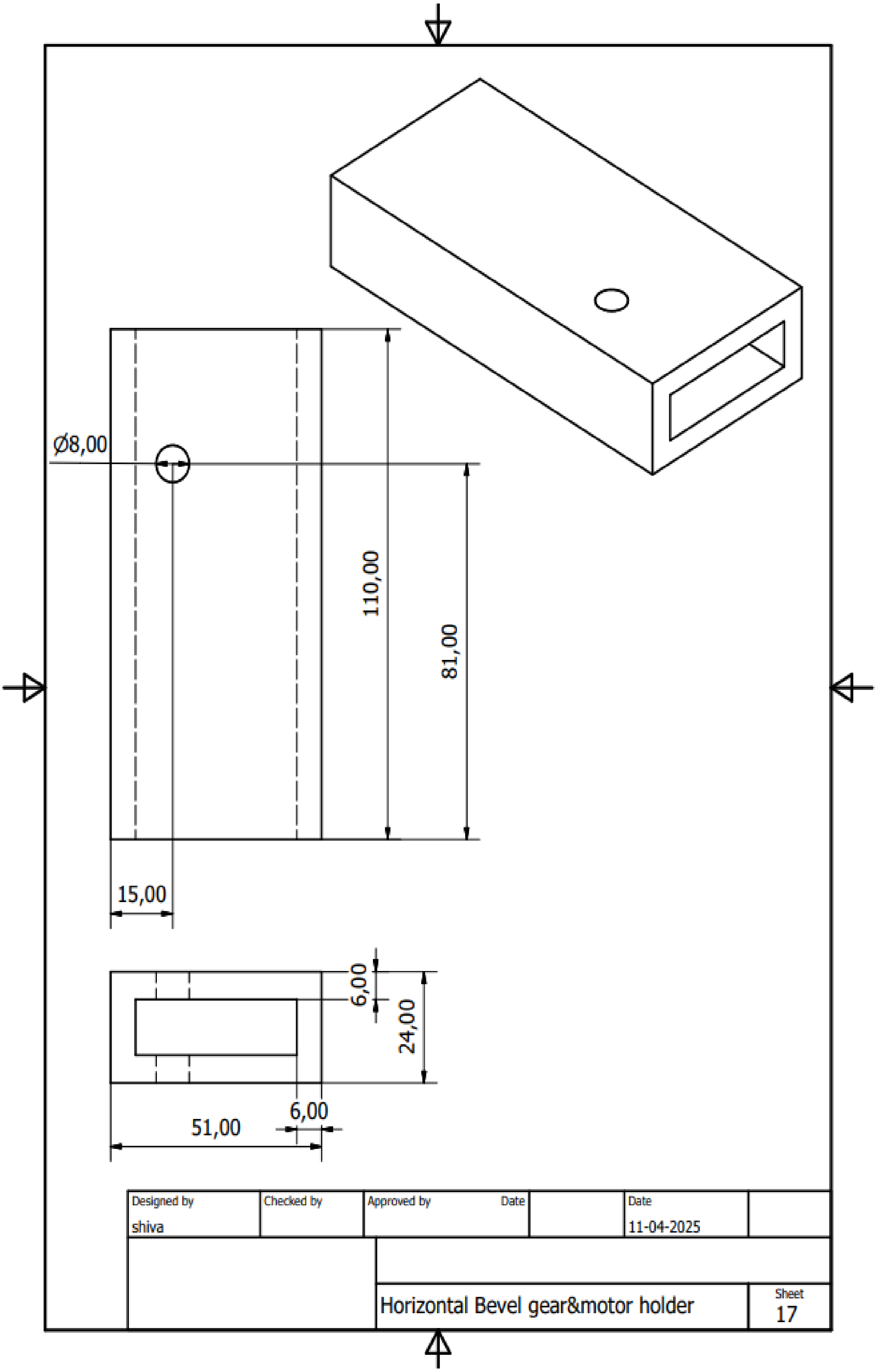
	Horizontal Bevel gear&motor holder2					Sheet 16



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11-04-2025
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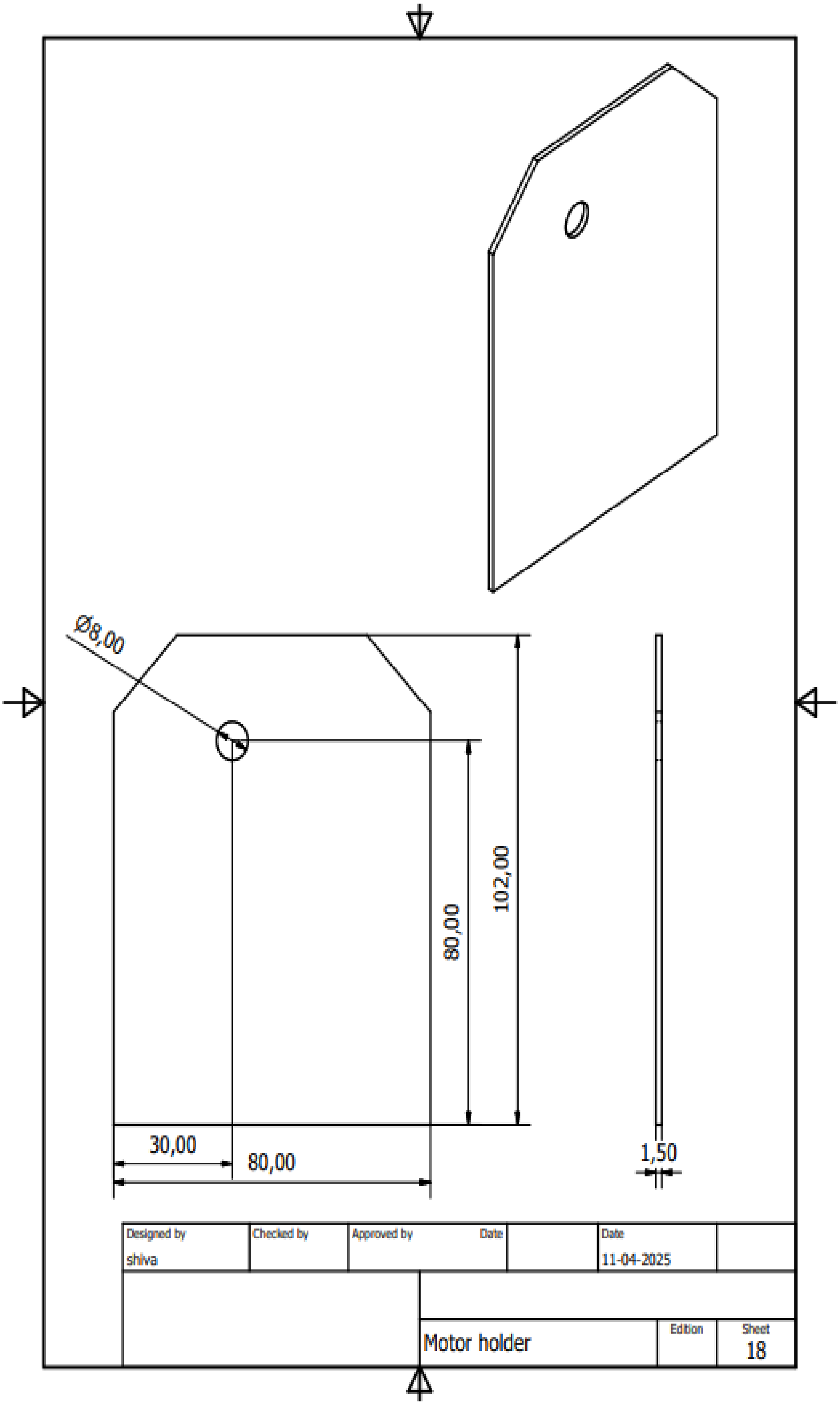
Sheet
17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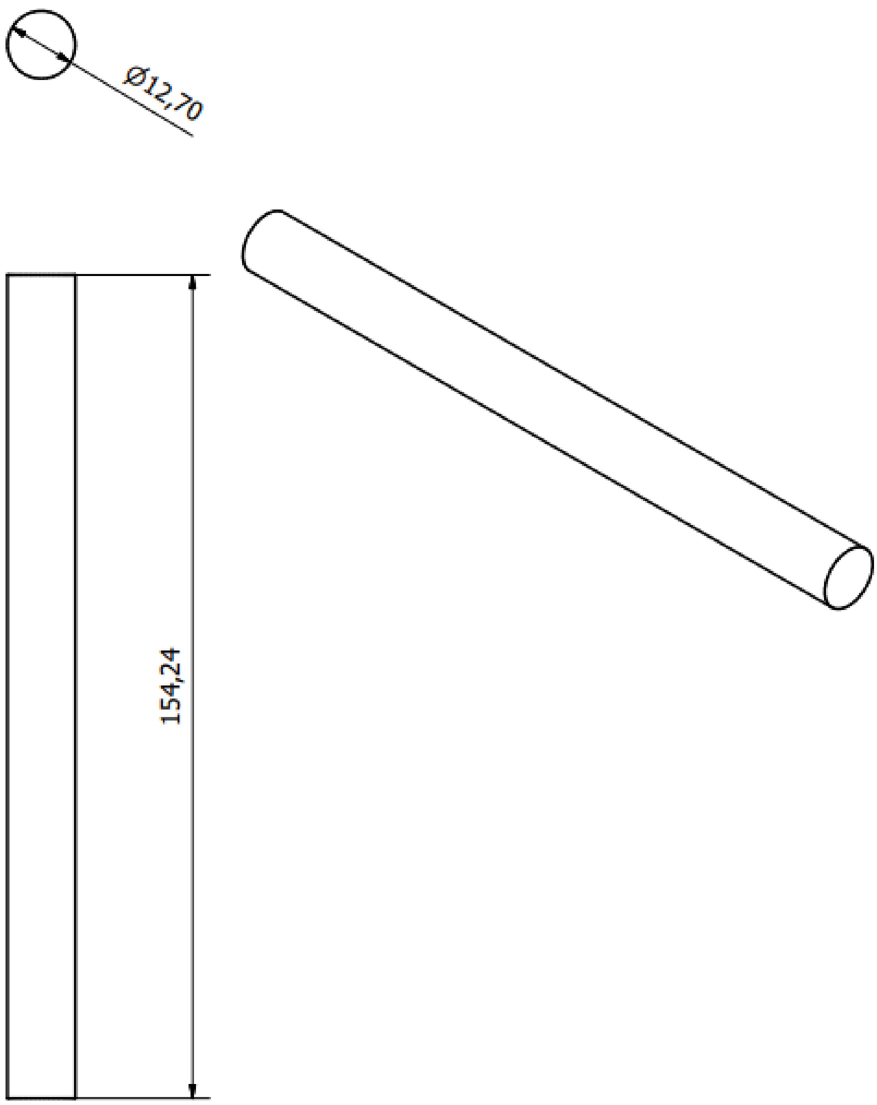
11-04-2025
Motor holder
Edition
Sheet
18



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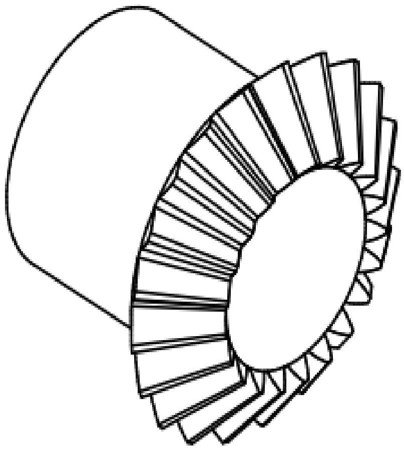
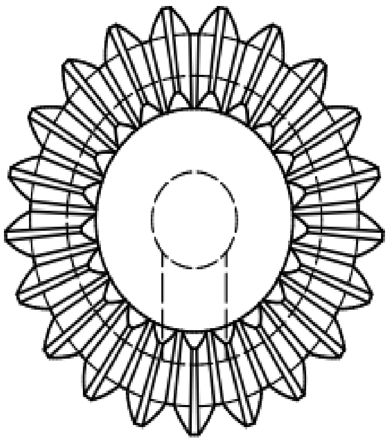
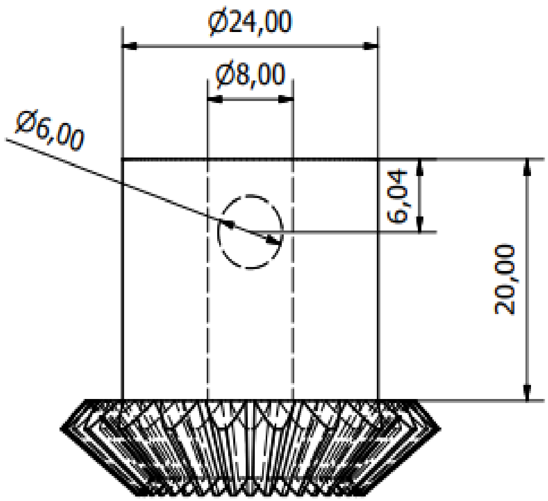
Bottom most rod				Edition	Sheet 19







no. of teeth = 21

diameter = 31.662

module = 1.5

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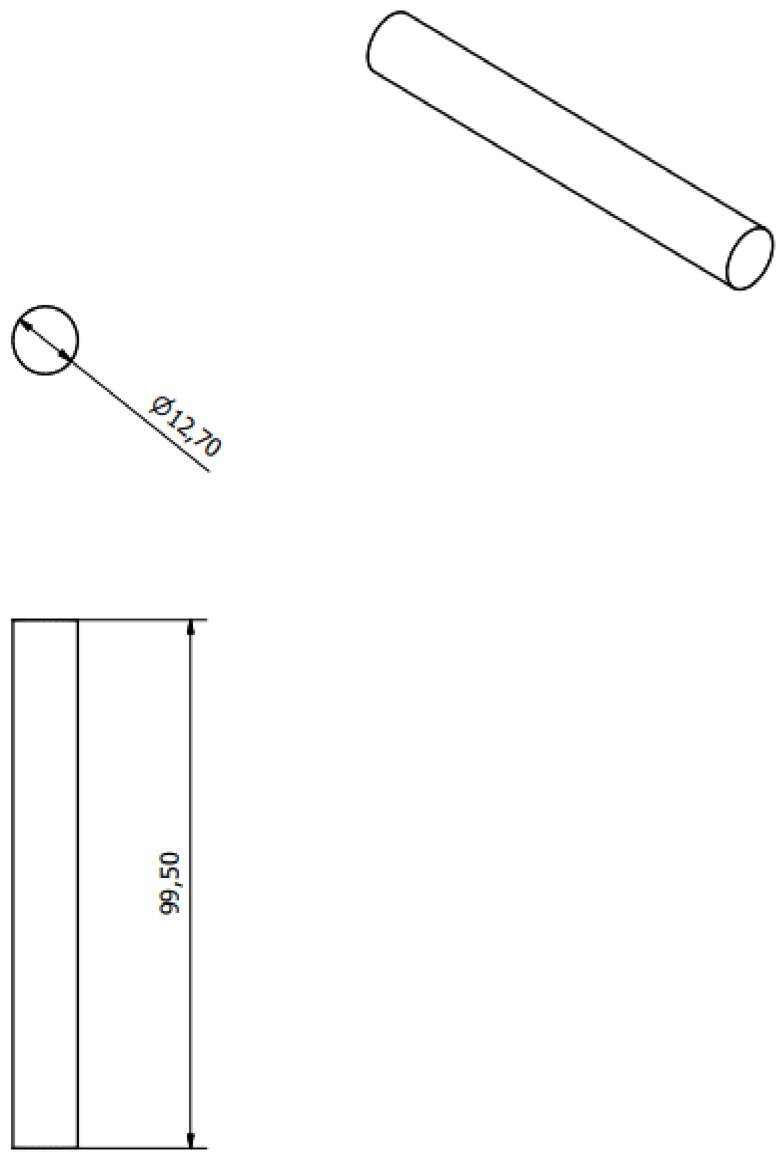
		Bevel Gear2		Edition	Sheet 20



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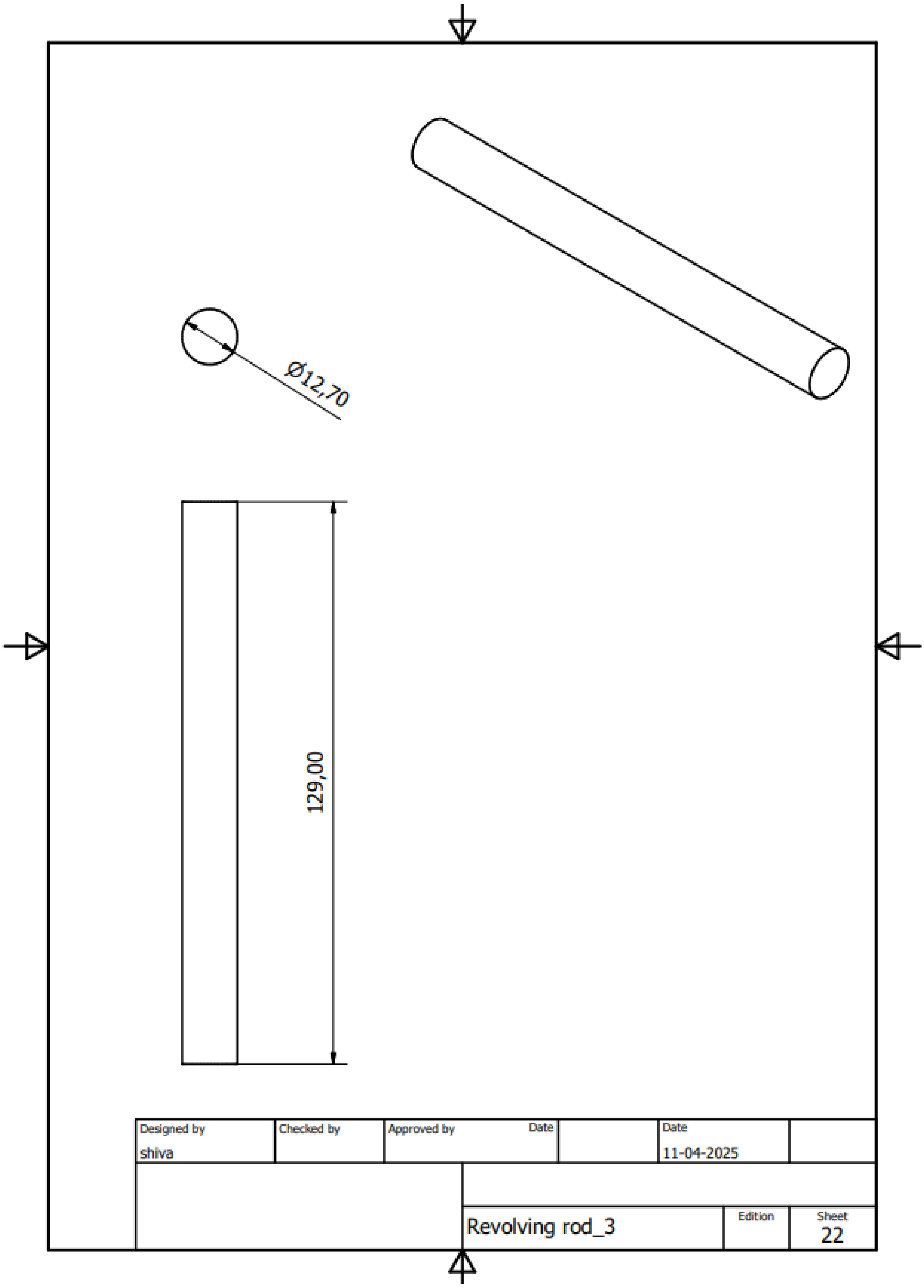
shiva					11-04-2025	

	Revolving rod_2	Edition	Sheet 21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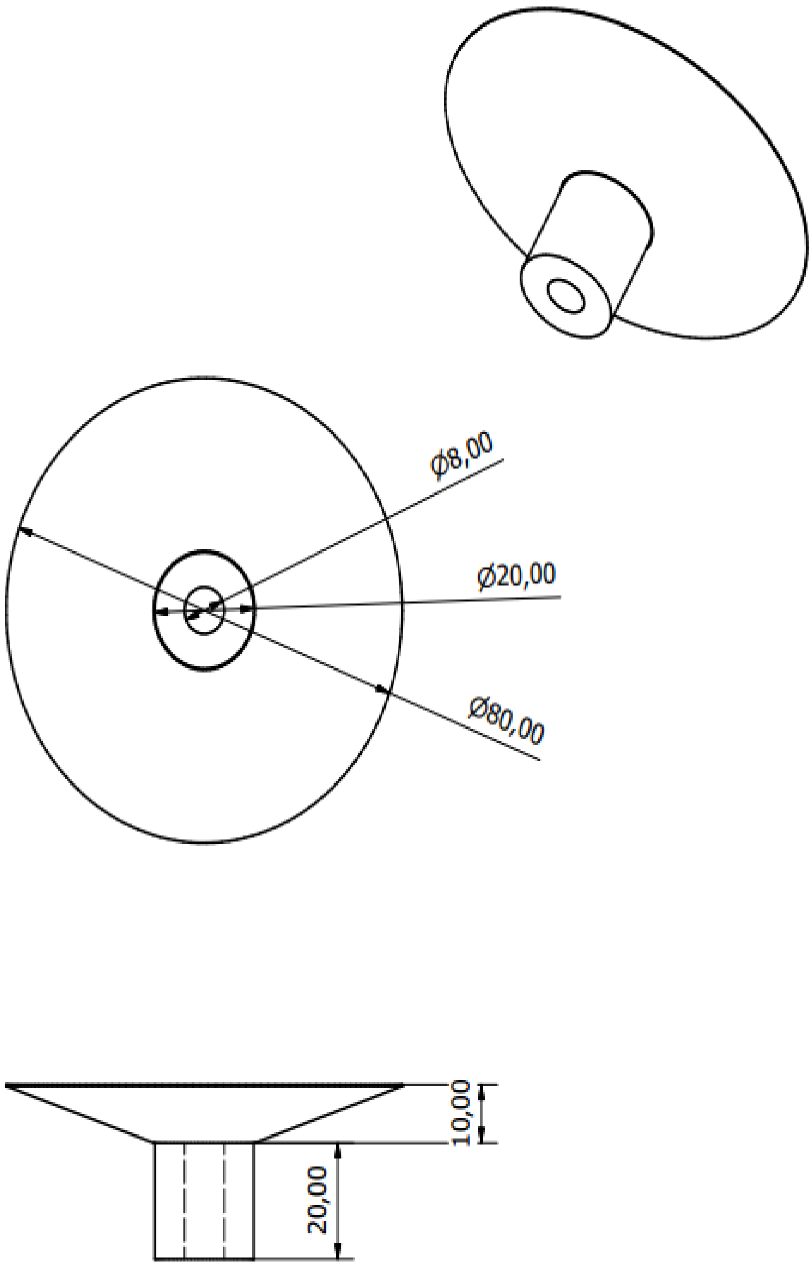
Date
Date
11-04-2025
Revolving rod_3
Edition
Sheet
22



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shiva				12-04-2025	
	Saucer			Edition	Sheet 23

Cost Analysis

Sr no.	Raw material	quantity	Price	total
1.	Mild steel	5kg	40 rs/kg	200 rs
2.	Pig Iron	5kg	45 rs/kg	220 rs
3.	PLA	300 gm	800 rs/kg	240 rs
4.	Chart paper	1 sheet	10 rs	10 rs
5.	Double tape	1 roll	40 rs	40 rs
6.	Servo motor	1	90 rs	90 rs
7.	Arduino UNO	1	450 rs	450 rs
8.	12V DC square motor 30 rpm	1	1237 rs	1237 rs
	Total			**2487**

Manufacturing Costs

Machine Type	Time (Hours)	Cost (Rs.)
Drilling	2	110
Milling	5	1,250
Turning	1	150
Lathe	6	2,100
CNC	0	0
3D Printing	9	900
Total Machining Cost	**23 Hours**	**4510**

Labor cost

Total work hours= 7 persons x 6 lab turns x 3 hours =126 hours

Skilled labour cost = 850 rs/8 hrs
Total labor cost= 13387 rs/-

Total cost of project= 2487+4510+13387= 20384 rs/-