TA202A PROJECT REPORT

BASCULE BRIDGE

[Group No. 45 ; Thursday]

Group Members :

Aakanksha Angelina (210005)

Aakarsh Mishra (210008)

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Mridul Nambiar (210633)

Netraj Rane (210664)

Ritwik Shankar (210866)

Shreya Rajak (211000)

Tushar Kumar (211116)

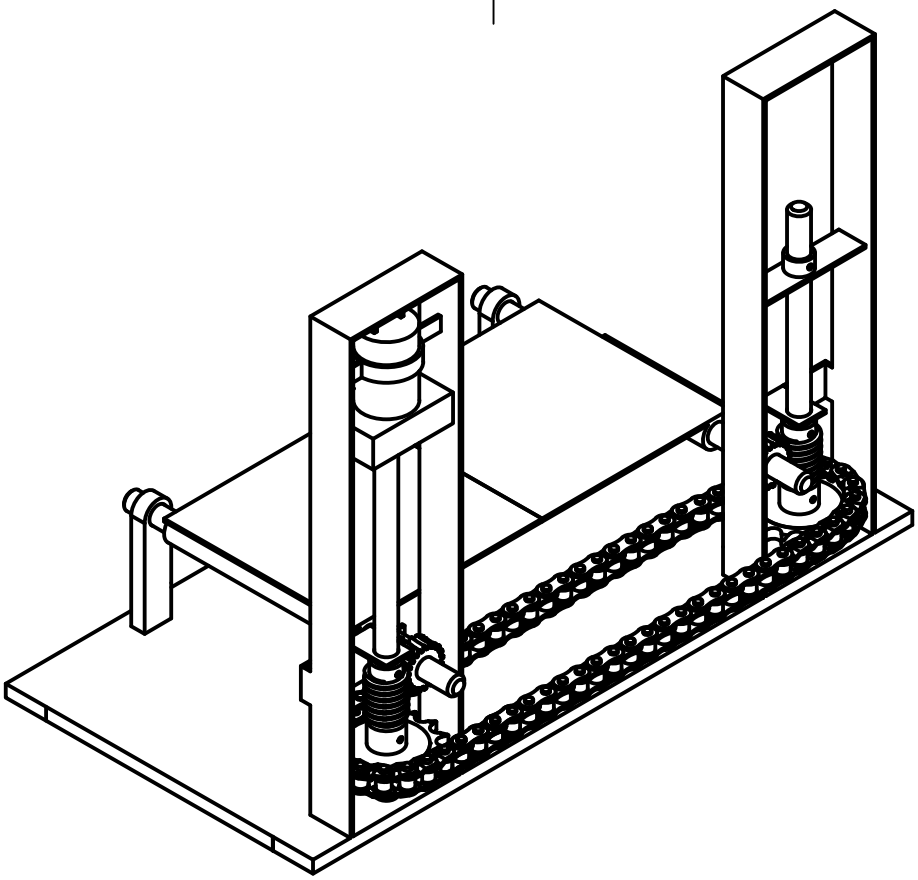
Yash Hatwar (211188)

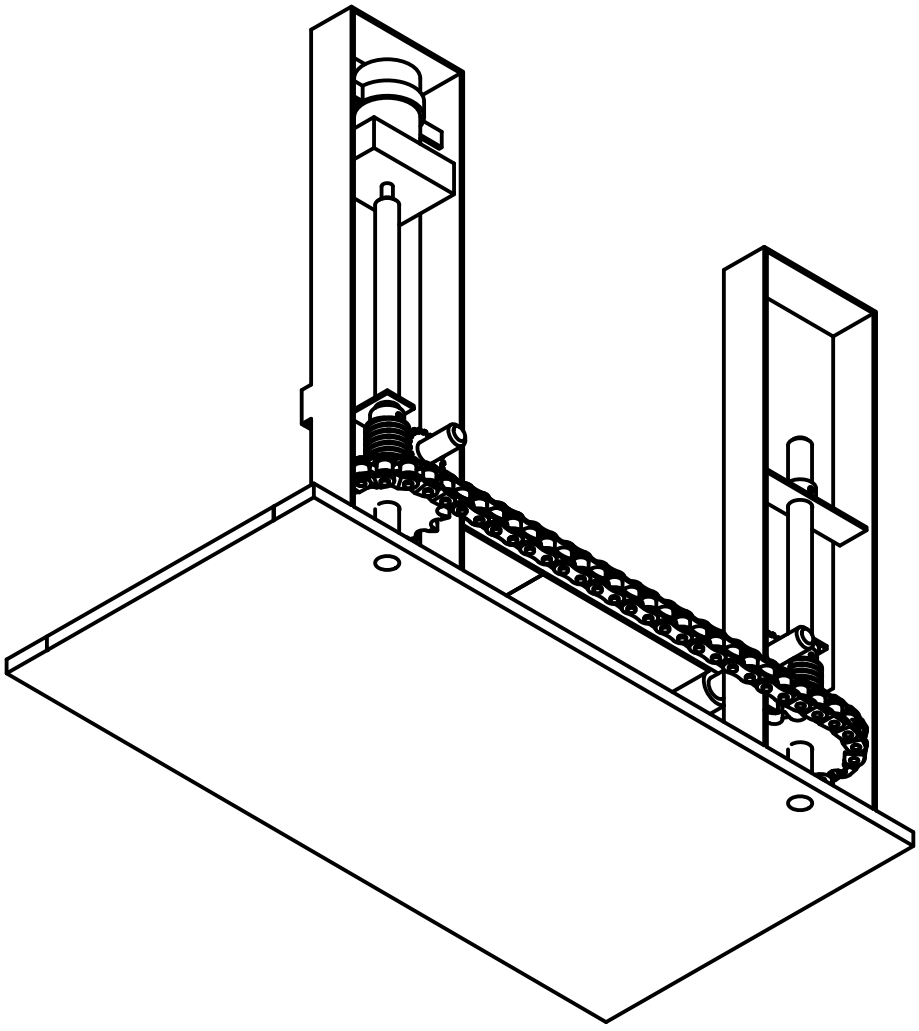
Course Instructor : Dr. Arvind Kumar

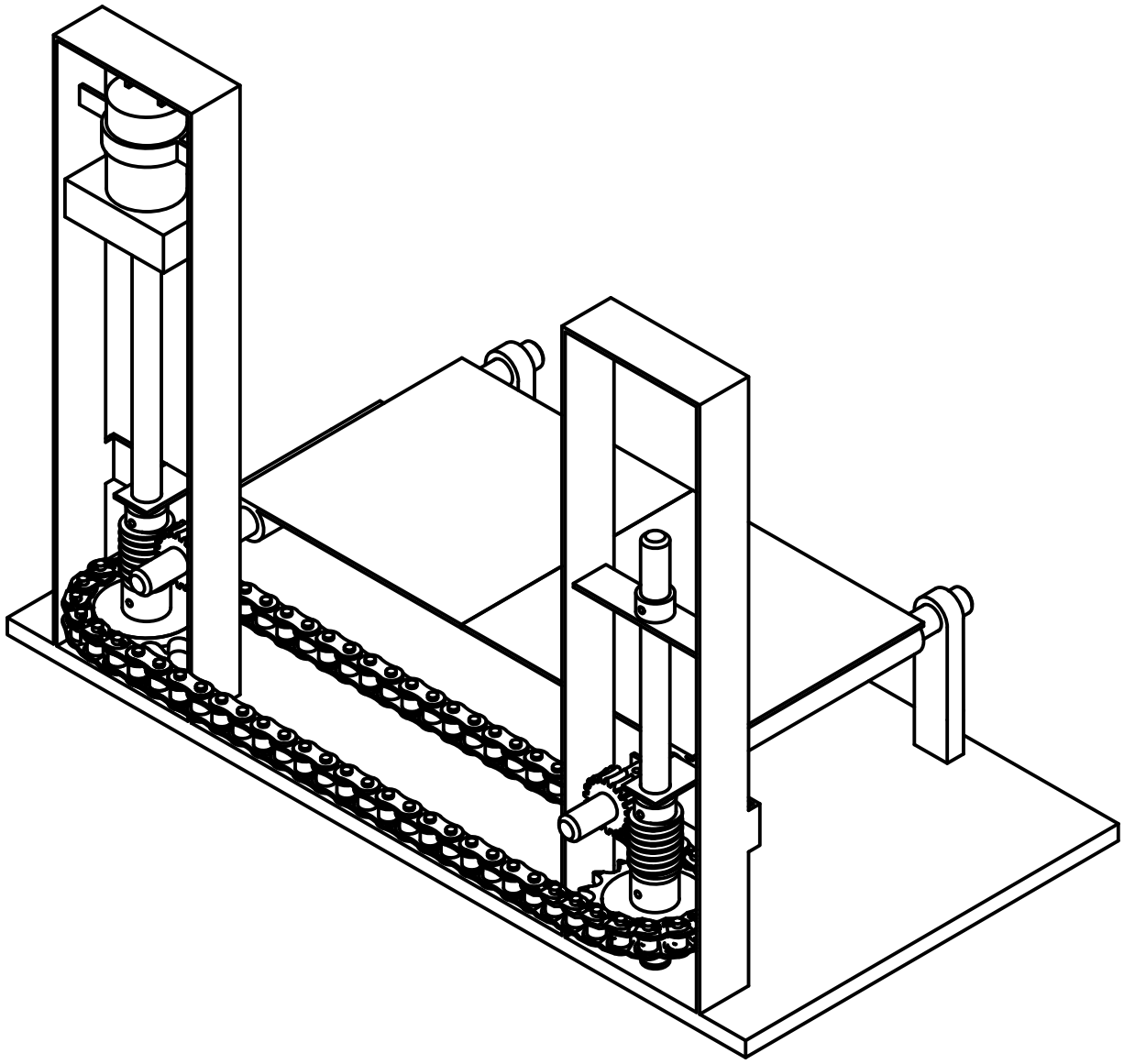
Guide : Mr. Kishan Babu Prajapati

INDEX

Part No.	**Part name**	**Dimensions**	**Quantity**
	Isometric view		
1	Base plate	450x229	1
2	Support beams	320x30	2
3	Support head	84x30	2
4	Shaft	$\phi 12.7$x242	2
5	Shaft	ϕ12.7x221	2
6	Bridge	142x140x20ϕ	2
7	Worm wheel	D_{pitch}=25, m=1.25	2
8	Worm drive	L_{pitch}=4.7 m=1.25	2
9	Sprocket	index=4.44 OD = 42.513	2
10	Chain link	pitch=12.70 R80	–
11	Motor mount	OD=39 support=20.5	1
12	Rod clamp	OD=16.9 height=10	1
13	Support	Refer orthography	1
14	Support 2	Refer orthography	1
15	Rod support	82x10	2







INTRODUCTION

Bridges are a common feature of the built environment and one of the key elements of civil engineering. The basic principles of bridge design are dependent on the load bearing structure. These are generally beam, arch and suspension structures. Moveable bridges are defined by their functionality. A bascule bridge (also referred to as a drawbridge or a lifting bridge) is a moveable bridge with a counterweight that continuously balances a span, or leaf, throughout its upward swing to provide clearance for boat traffic. It may be single- or double-leafed. The name comes from the French term for balance scale, which employs the same principle. Bascule bridges are the most common type of movable span because they open quickly and require relatively little energy to operate, while providing the possibility for unlimited vertical clearance for marine traffic. Bascules originated in the medieval castle drawbridge, which provided a water crossing and an effective barricade when raised. In the Middle Ages, they were used for defensive purposes in Europe. These drawbridges were typically operated by counterweights and winches. Experimentation with the bascule form began with the need for a bridge that could quickly open and close to facilitate waterway traffic below. Interest in the bridge type began in the early 1890s when Congress gave the War Department the national authority to approve all bridges over navigable waterways and the power to encourage the replacement of those bridges that interfered with the free flow of commerce. By the time of the Industrial Revolution, the adoption of modern technologies and the introduction of new power sources made it possible to create large spans. When the double-leaf Tower Bridge was built in the late 1800s, it incorporated both bascule and suspension bridge elements that could accommodate multiple types of traffic. The range of significant topographic features, rivers and streams has provided engineers throughout the years numerous opportunities and challenges for creating bridge structures of great beauty and versatility.

CONCEPTUAL DESIGN COMPONENTS :

Gear

Gears are used to transfer motion and torque between machine components in mechanical devices. Depending on the design and construction of the gear pair employed, gears can change the direction of movement and/or increase the output speed or torque.

Sprocket and Chain:

A chain and sprocket drive is a type of power transmission in which a roller chain engages with two or more toothed wheels or sprockets, used in engines as a drive from crankshaft to camshaft.

Shaft:

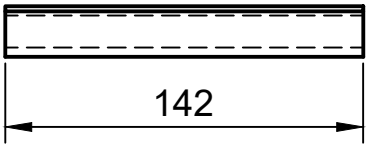
A shaft is a rotating machine element, usually circular in cross section, which is used to transmit power from one part to another, or from a machine which produces power to a machine which absorbs power.

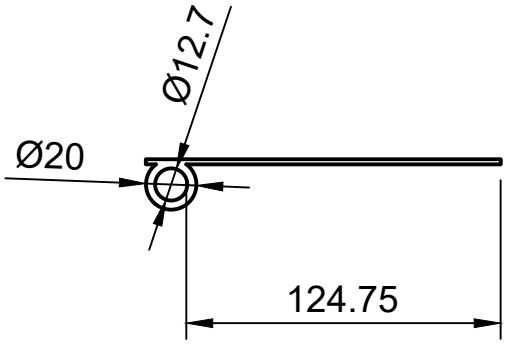
Rotor:

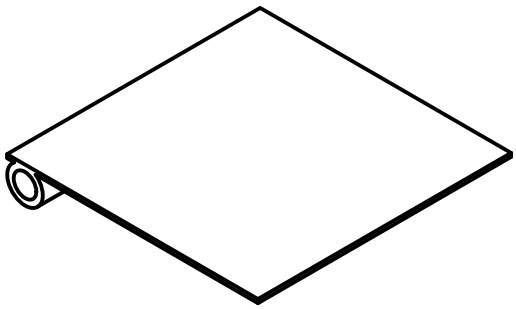
Rotors are the moving part in an Alternator that have permanent magnets that move around the Stator's iron plates to generate an Alternating Current (AC).

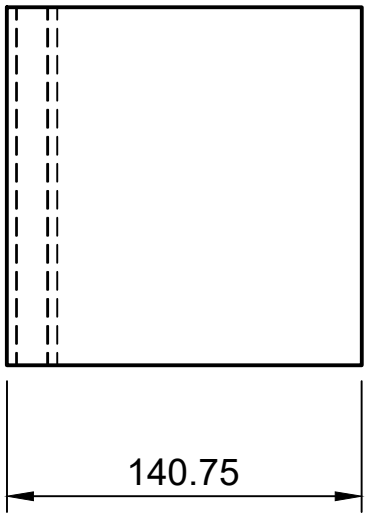
FUNCTIONING OF THE BRIDGE:

The functioning of the model takes place as follows: Firstly a motor is connected to one of the shafts. This shaft is further attached to a worm gear. As the motor moves, the worm gear transfers the rotation along the axis of the shaft by 90 degrees. As a result this raises the flap of the bridge. The shafts are now also attached to sprockets. These sprockets are connected further by a chain and therefore the movement of the motor would also result in the movement of another shaft which, as a result, opens up the next flap. In this way the bridge opens up when we turn on the moto

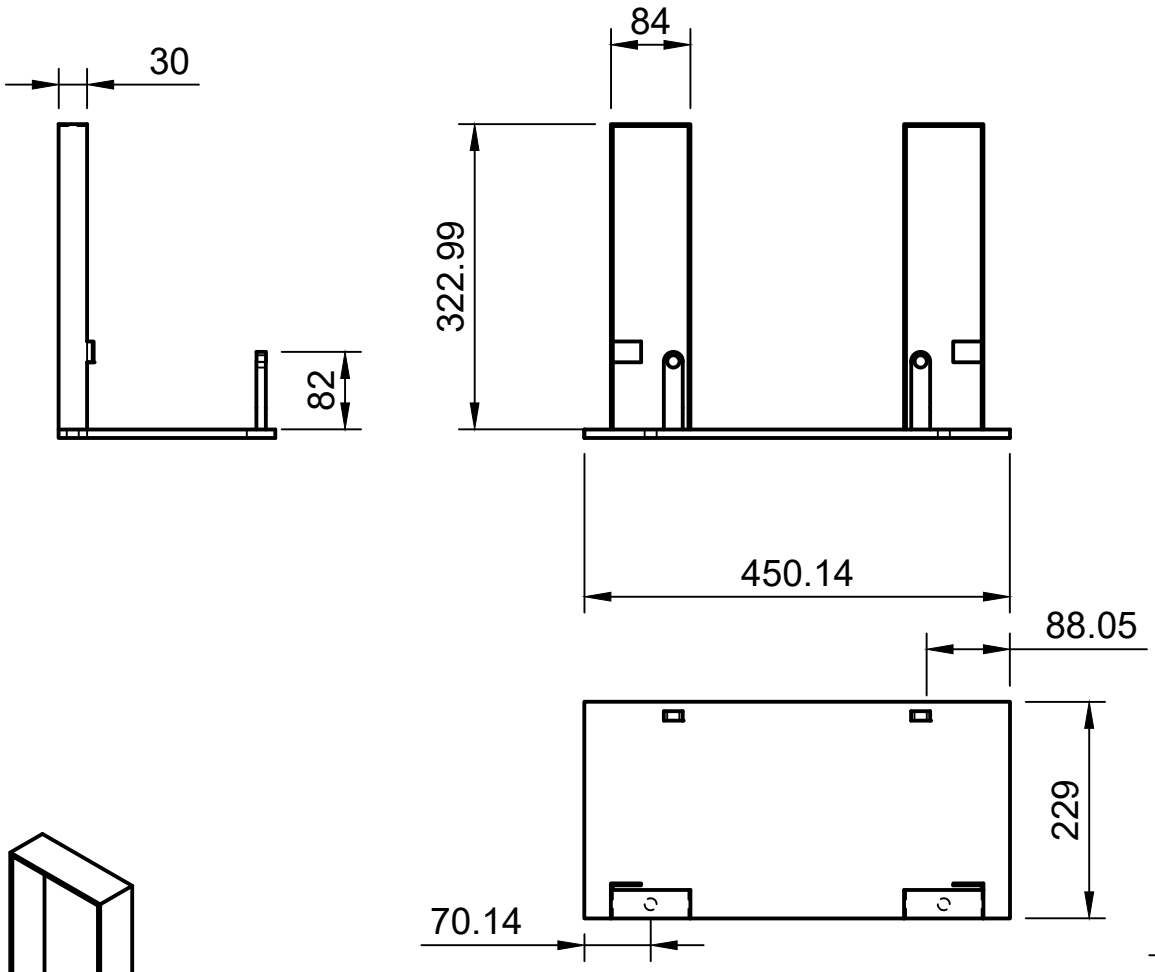


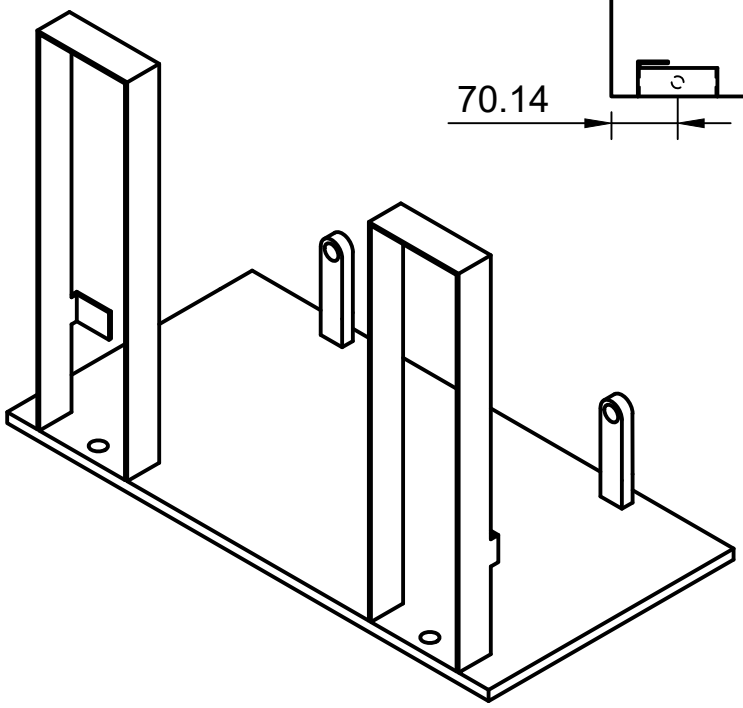




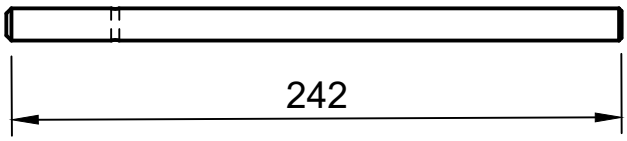


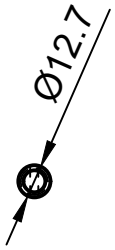
Drawn by : Mridul Nambiar	Part : Bridge Half1
Part No :	Material :
Instructor : Arvind Kumar	
Guide : Kishan Babu Prajapati	Quantity :
	Scale : 1:3 / Pg No:

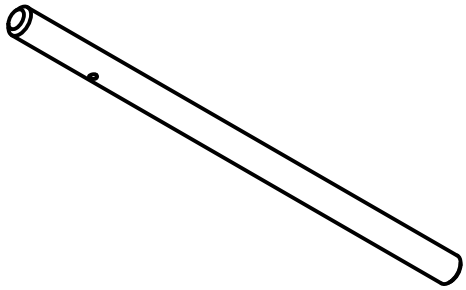




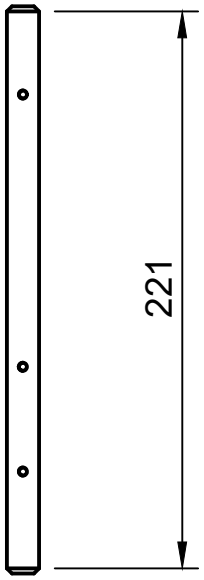
Drawn by : Mridul Nambiar	Part : Complete Base
Part No :	Material :
Instructor : Arvind Kumar	Quantity :
Guide : Kishan Babu Prajapati	Scale : 1:5 Pg No:

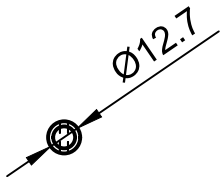




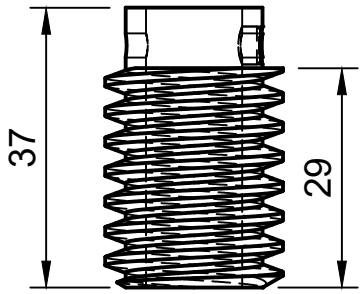


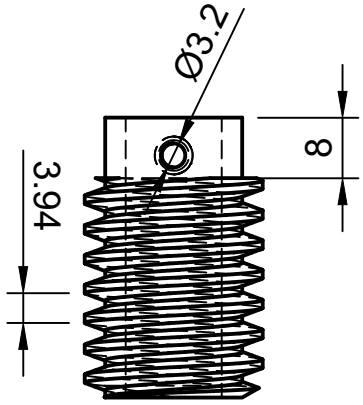
Drawn by : Mridul Nambiar	Part : Shaft 1
Part No :	Material :
Instructor : Arvind Kumar	Quantity :
Guide : Kishan Babu Prajapati	Scale : 1:3 Pg No:

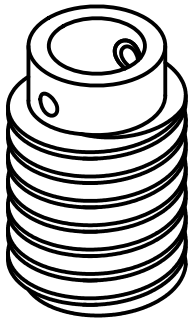


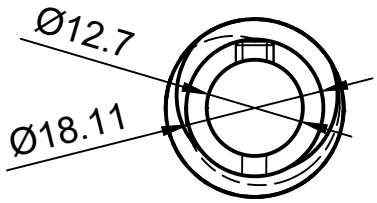


Drawn by : Mridul Nambiar	Part : Shaft 2
Part No :	Material :
Instructor : Arvind Kumar	Quantity :
Guide : Kishan Babu Prajapati	Scale : 1:3 / Pg No:

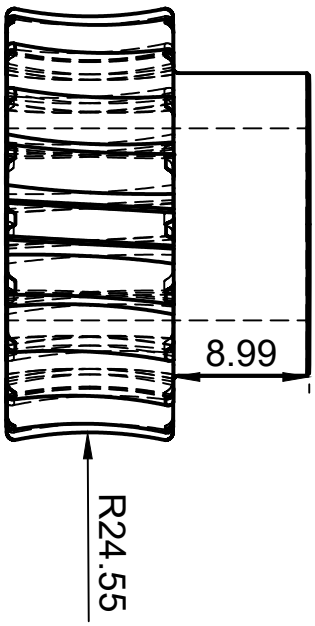


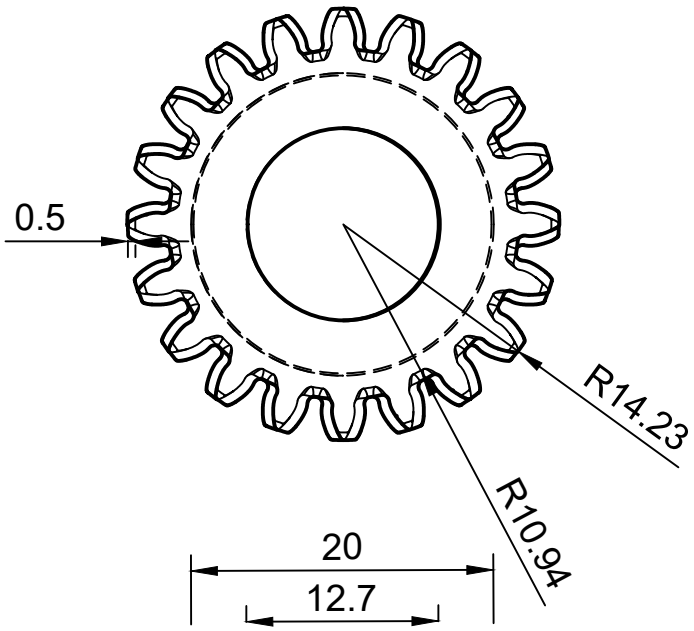


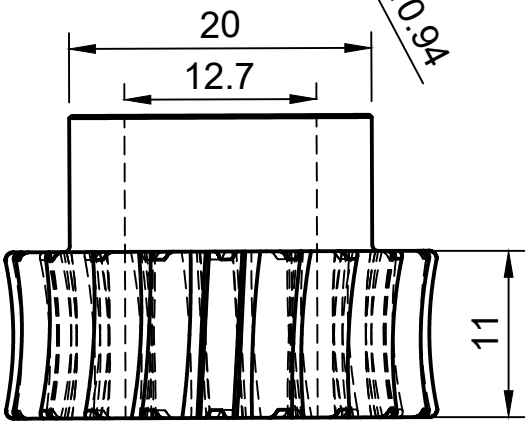


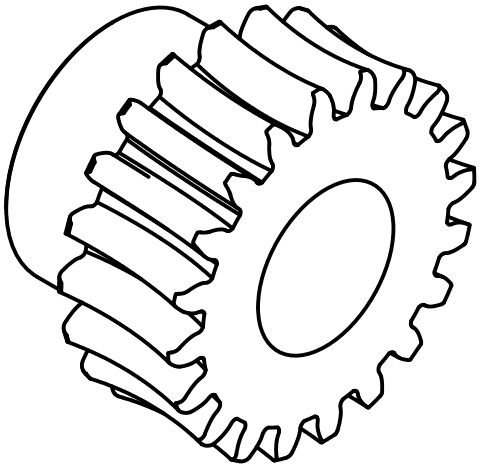


Drawn by : Mridul Nambiar	Part : Worm drive
Part No :	Material :
Instructor : Arvind Kumar	
Guide : Kishan Babu Prajapati	Quantity :
	Scale : 1:1 / Pg No:







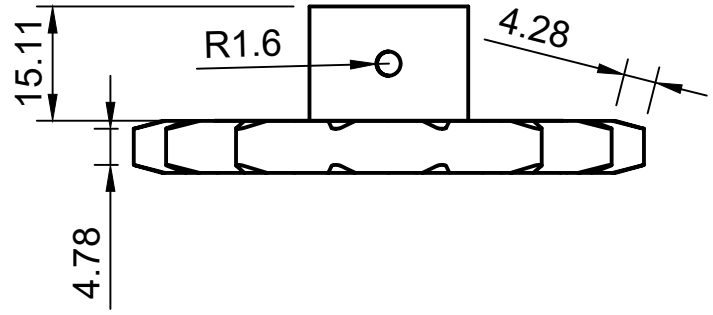


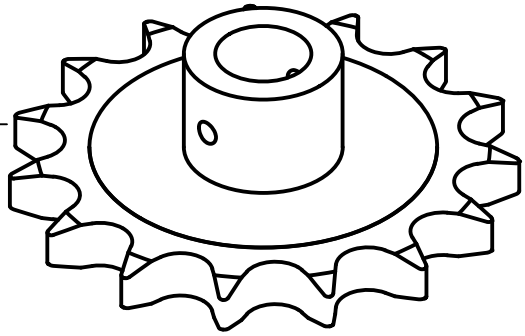
Drawn by : Netraj Rane	Part : Worm Wheel
Part No :	Material :
Instructor : Arvind Kumar	Quantity :
Guide : Kishan Babu Prajapati	Scale : 2:1 / Pg No:

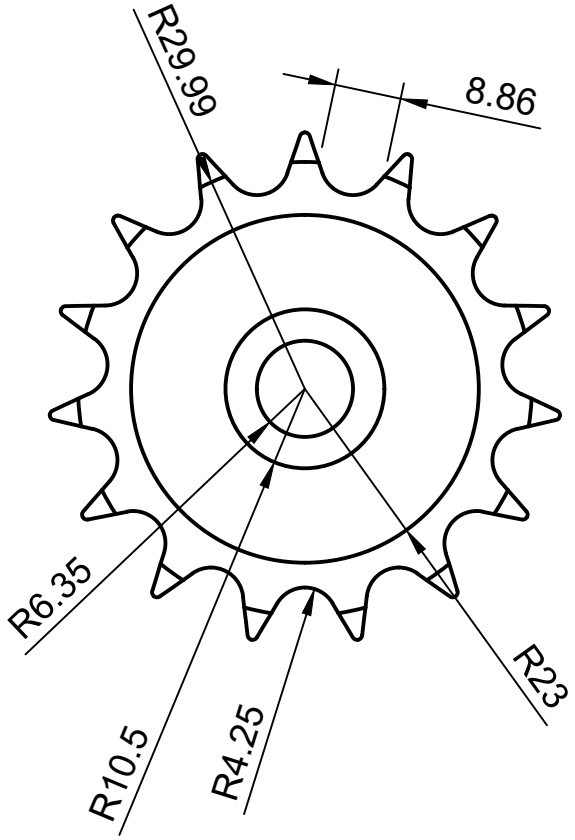
WORM WHEEL ASSEMBLY CALCULATIONS`

Pitch of the single start worm = 4.7 mm
Outside diamete=22
Ratio of worm & worm wheel = 20 : 1
Face angle = 60°
Lead of worm = pitch x No. of start = 4.7 x 1 =4.7

Addendum of the worm (u)=(do-d)/2= 0.3183 x Pitch = 0.3183 x4.7 =1.49601mm
Pitch diameter of the worm (d) = d, - 2a = 22 - 2 x 1.49601=19.007 mm
Depth of worm tooth (h,) = (do - dr) / 2= 0.6866 x Pitch = 0.6866 x4.7=3.227
Root diameter of worm (d,) = do - 2h, = 22 - 2 x 3.227 =15.546 mm
Pitch diameter ol the wheel (D) = (N x P) / pi =20x 4.7/3.1416 = 29.92 mm
Centre distance between worm & worm wheel (C) = (D + d]/ 2 = (29.921 + 19.007)/2=24.464 mm
Throat diameter of the wheel (Do) = D + 2 a = 29.921 - 2 x1.49601 = 32.913mm
Throat radius of the worm wheel (r) = do/2-2a = 8.008 mm
Diameter of the wheel over the sharp corners (D_o) = 2r (1-cos Θ /2) + Do = 44.925 mm
Face width of the wheel=2.38* p + 6.35 mm=17.536 mm
Helix angle of worm Tan α = pi*d/ lead = 12.7047
α = 85.499°
Hashing angle of the worm wheel α_g=90 - 85.499=4.501°







Drawn by : Mridul Nambiar	Part : Sprocket
Part No :	Material :
Instructor : Arvind Kumar	
Guide : Kishan Babu Prajapati	Quantity :
	Scale : 1:1 / Pg No:

Sprocket dimensional calculations

No. of teeth (N_t) $= 9$

Pitch = 12.70

Pitch diameter (P.D.) = $\frac{pitch}{sin(180^0/N_t)}$ = $\frac{12.70}{sin(20)}$

= 37.132

Outer diameter (O.D.) = $pitch * (0.6 + cot(180/N_t)$

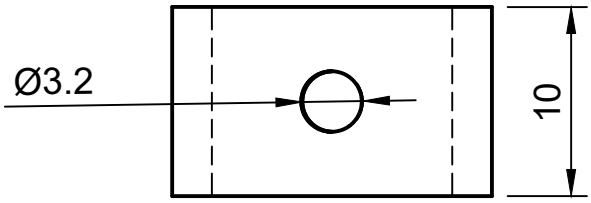
=12.70*(0.6+cot(20))

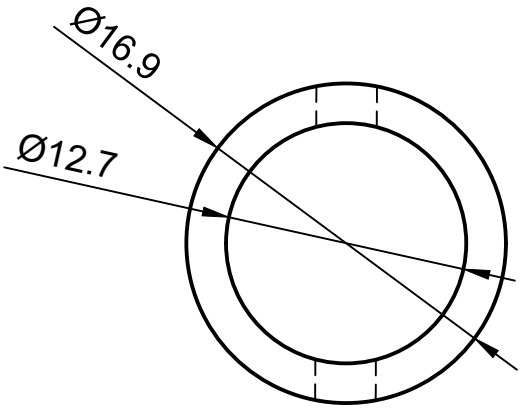
=42.513

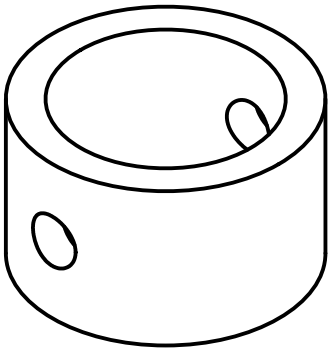
Diameter of sprocket bore = diameter of shaft

=12.7

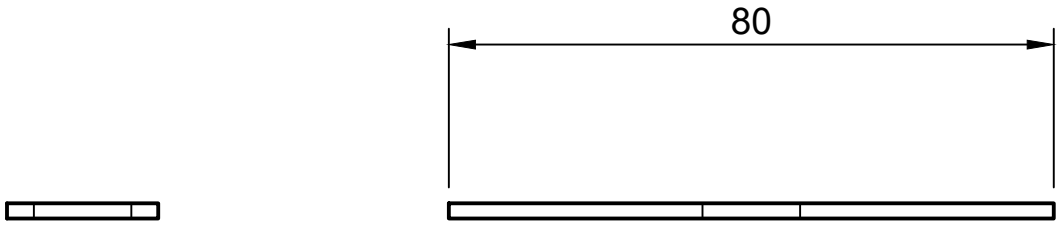
Index = 40/N_t = 40/9 = 4.44

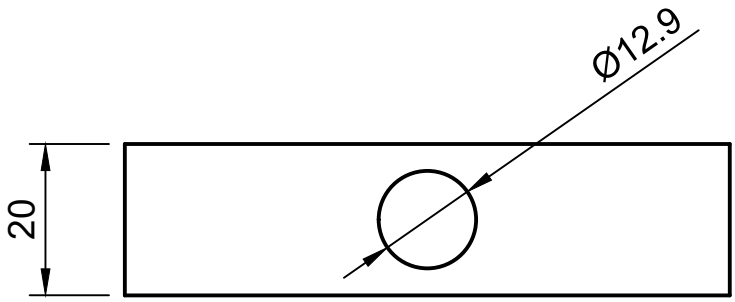


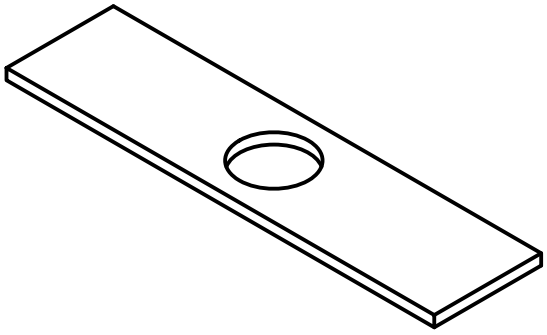




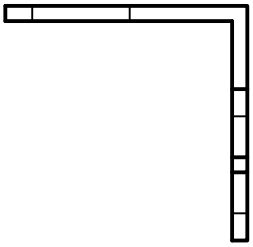
Drawn by : Tushar Kumar	Part : Rod Clamp
Part No :	Material :
Instructor : Arvind Kumar	Quantity :
Guide : Kishan Babu Prajapati	Scale : 2.5:1 / Pg No:

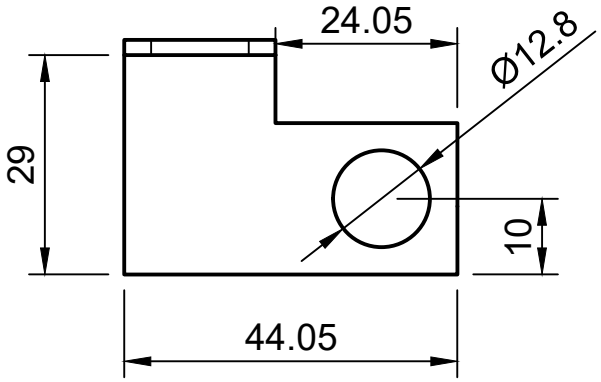


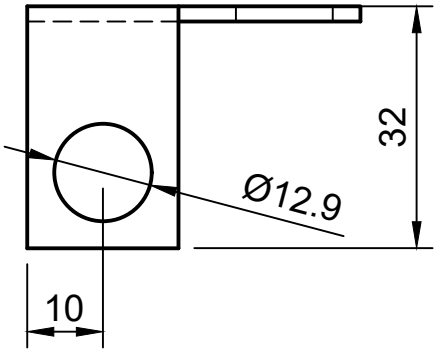


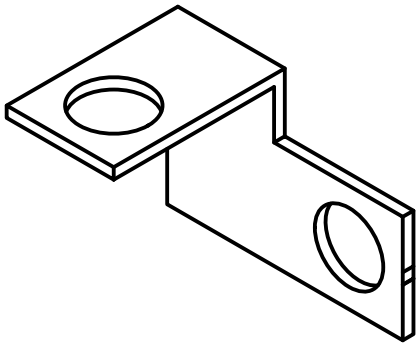


Drawn by : Mridul Nambiar	Part : Rod Mount
Part No :	Material :
Instructor : Arvind Kumar	Quantity :
Guide : Kishan Babu Prajapati	Scale : 1:1 / Pg No:

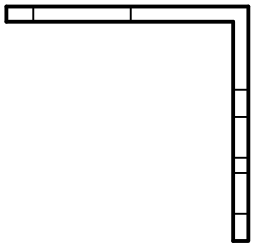


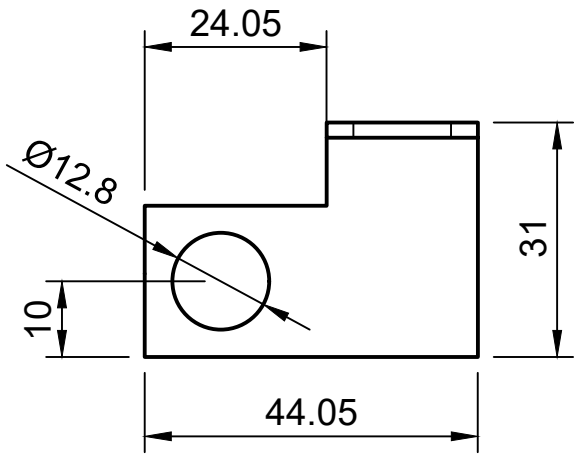


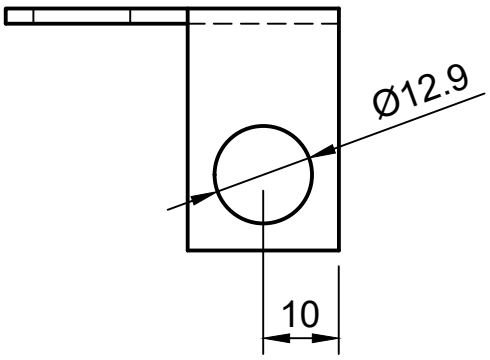


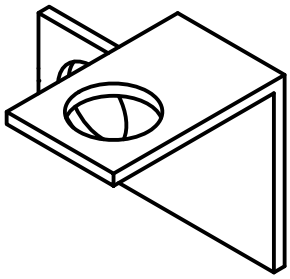


Drawn by : Mridul Nambiar	Part : Support 1
Part No :	Material :
Instructor : Arvind Kumar	
Guide : Kishan Babu Prajapati	Quantity :
	Scale : 1:1 / Pg No:









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Part No :	Material :
Instructor : Arvind Kumar	
Guide : Kishan Babu Prajapati	Quantity :
	Scale : 1:1 / Pg No: