AHMEDABAD UNIVERSITY | School of Engineering and Applied Science

PIPING NETWORK

Group - 1D

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Aim and objectives

Aim:

- To design a bench top model of piping network using different pipe joints and calculating the pressure drops across each sections.

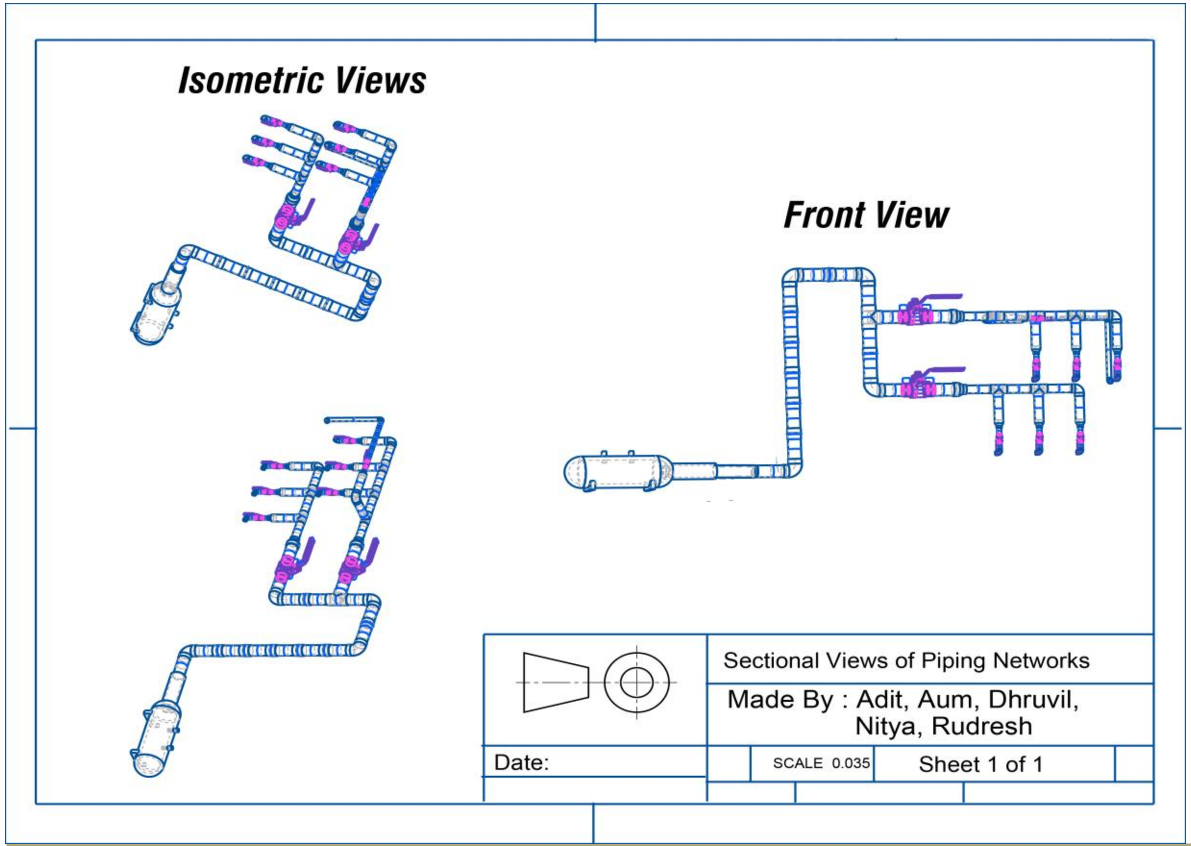
Objectives:

- To design a bench top model of piping network using different pipe joints like Straight pipe section, Elbow 90°,Pipe joint connector, Pipe enlarger / reducer, T-Joint to determine the flow rates and pressure drops.
- Also to calculate friction factor across the straight pipe.

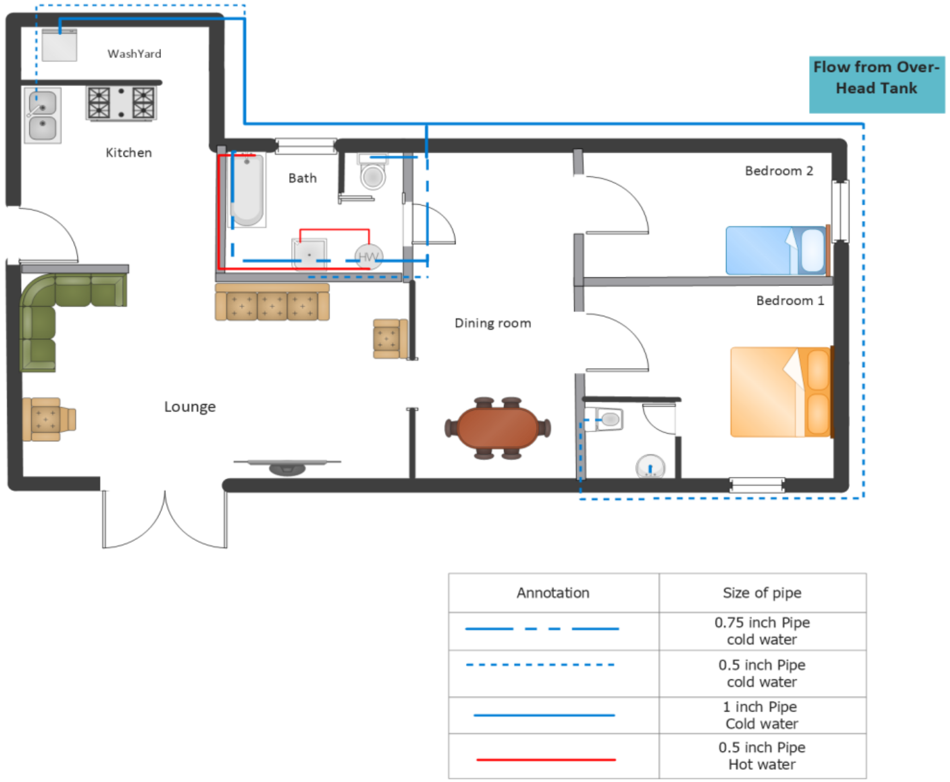
Introduction

- In fluid dynamics, pipe network analysis is the analysis of the flow-through a pipe network, containing several or many interconnected branches. The aim of the analysis is to determine the flow rates and pressure drops in the individual sections of the network.
- Piping network system has significant role in industrial sector to minimize losses through designing effective and simplest network. The objective of project is to explore overview of piping network system design, its requirements and also to find the flow rate, pressure drop and friction factor for different heads and different length of pipe and joints. By this experiment we will get to know the changes that take place in pressure and flow rate at different height and at different angles of pipe.

CAD model Of Our Network



Floor Plan(Visualization) of Piping network of a Residence



Project Design

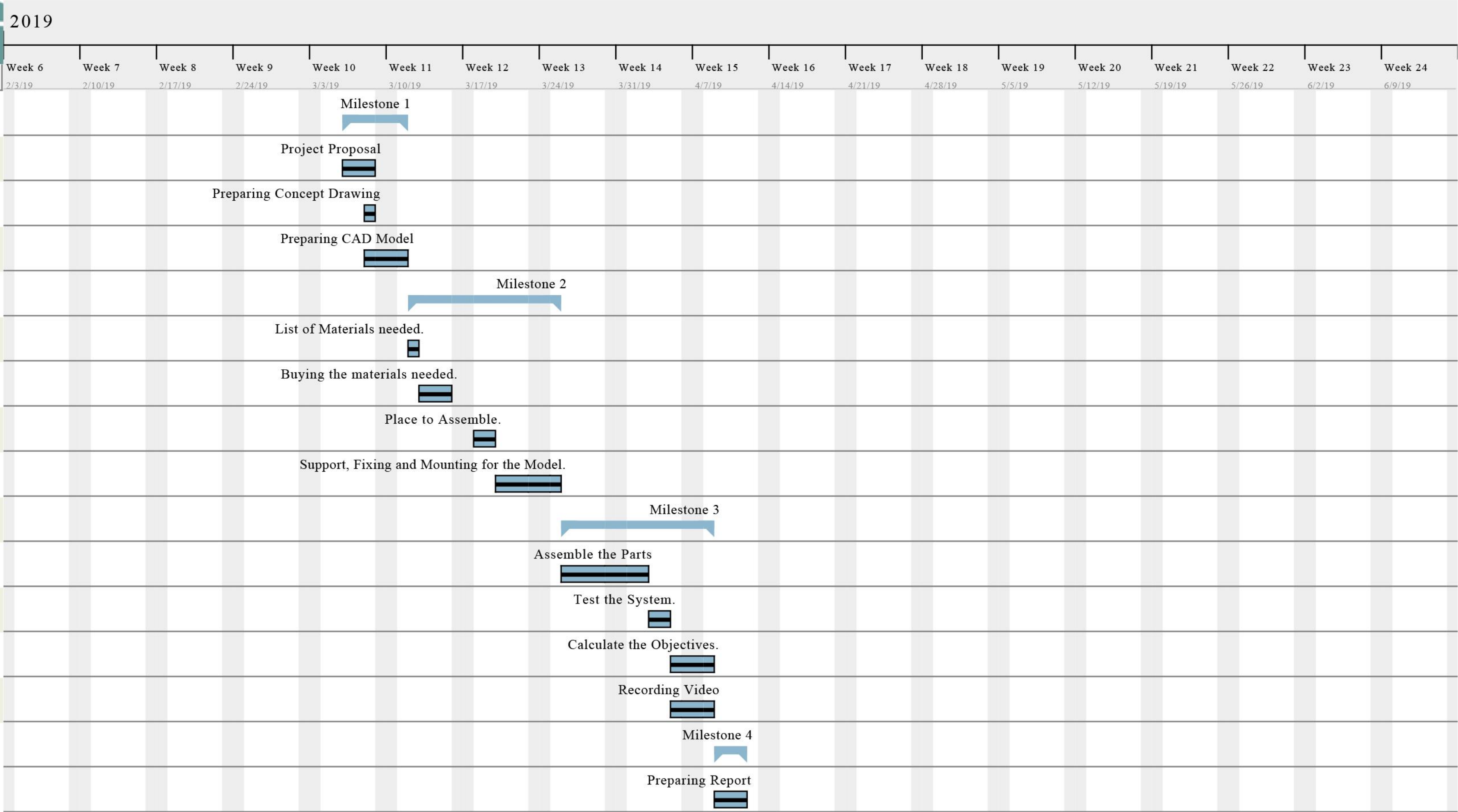
Process Flowchart

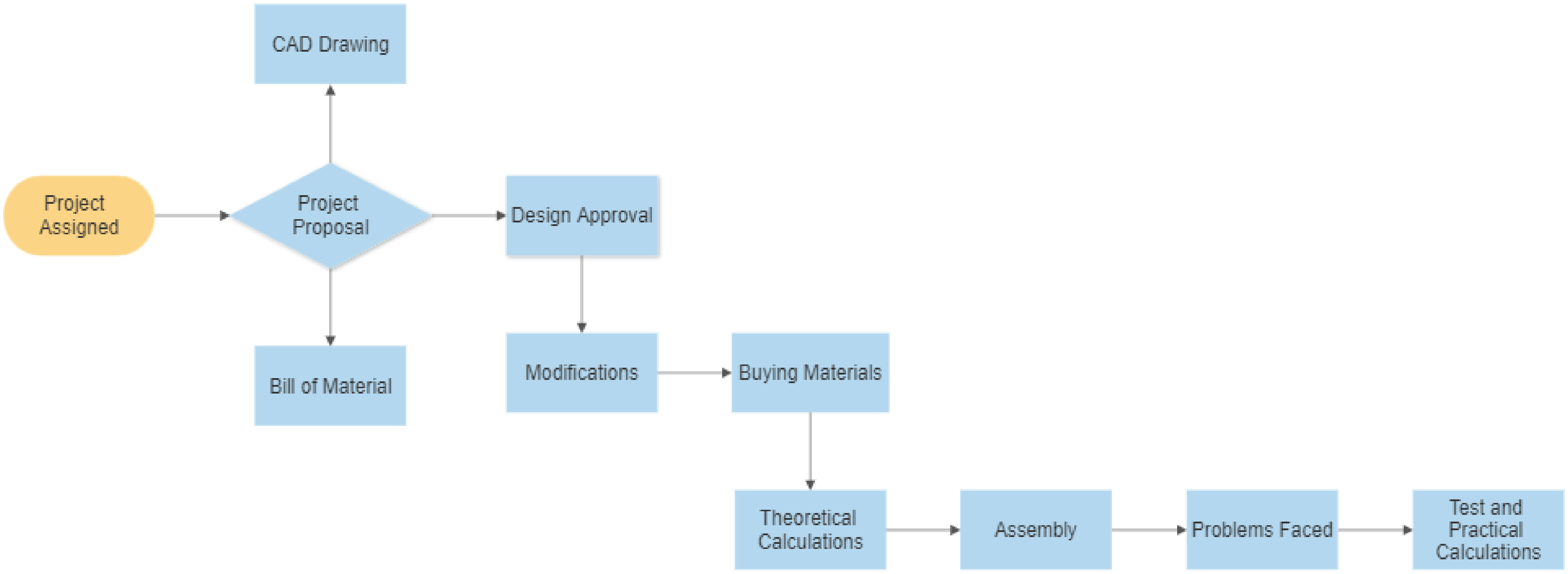
Fluid Mechanics Lab

May 13, 2019

Gantt Chart

Name	Begin date	End date
Milestone 1	3/6/19	3/11/19
Project Proposal	3/6/19	3/8/19
Preparing Con...	3/8/19	3/8/19
Preparing CAD...	3/8/19	3/11/19
Milestone 2	3/12/19	3/25/19
List of Material...	3/12/19	3/12/19
Buying the ma...	3/13/19	3/15/19
Place to Assem...	3/18/19	3/19/19
Support, Fixin...	3/20/19	3/25/19
Milestone 3	3/26/19	4/8/19
Assemble the ...	3/26/19	4/2/19
Test the System.	4/3/19	4/4/19
Calculate the ...	4/5/19	4/8/19
Recording Vid...	4/5/19	4/8/19
Milestone 4	4/9/19	4/11/19
Preparing Rep...	4/9/19	4/11/19




Project Assigned
Project Proposal
CAD Drawing
Bill of Material
Design Approval
Modifications
Buying Materials
Theoretical Calculations
Assembly
Problems Faced
Test and Practical Calculations

Theoretical Calculation

V_{avg} = Q/A where $A = \frac{\pi}{4}d^2$, Q = Volume/time (m^3/s)

Darcy - Weisbach equation:

- **$\Delta P/10^5 = f*(L/D)*\rho*(V_{avg}^2/2)$**

where:
ΔP = Pressure drop (bar)
f = friction factor
L = length of pipe work (m)
D = inner diameter of pipe work (m)
v = velocity of fluid (m/s)

f = 0.009 (From Moody's chart)

- We can find friction factor from Moody's chart because flow is turbulent

Assumptions

- We have taken plastic pipe and for plastic pipe equivalent roughness is 0 so pipe is smooth. Relative pipe roughness is also 'zero'. So, friction factor for smooth pipe is 0.008 to 0.009.
- Here, we have ignored all the minor losses because of they all are very less than the major losses.

Theoretical Calculation Continued

THEORETICAL VALUES

PRESSURE DROP IN 1 INCH DIAMETER PIPE (ΔP= 0.0011 bar)

- L = 3.71 m
- D = 0.024 m
- V_{avg} = 0.22 m/s

PRESSURE DROP IN 0.75 INCH DIAMETER PIPE (ΔP= 0.05 bar)

- L = 1.71m
- D = 0.018m
- V_{avg} = 2 m/s

PRESSURE DROP IN 0.5 INCH DIAMETER PIPE (ΔP= 0.351 **bar)**

- L = 0.73m
- D = 0.012m
- V_{avg} = 11.32 m/s

Practical Calculation

PRACTICAL VALUES

PRESSURE DROP IN 1 INCH DIAMETER PIPE :

- P_a = 0.1951 bar , P_b = 0.1961bar
- ΔP = 0.001 bar (converted from kg/cm^2 to bar, 1.02 kg/cm^2 = 1 bar)

PRESSURE DROP IN 0.75 INCH DIAMETER PIPE :

- We have designed parallel pipe network for 0.75 inch

  P_1 = 1.05bar , P_2=1.2 bar so, equivalent pressure(P_b) will be 0.56 bar and P_a = 0.35 bar
- So, we got approximately ΔP = 0.21 bar

PRESSURE DROP IN 0.5 INCH DIAMETER PIPE :

- P_a = 1.127 bar , P_b = 1.569 bar
- ΔP = 0.442 bar

Conclusion

- The flow of water in different pipe network was investigated in this experiment.
- The pressure loss, friction factor and the pipe roughness were obtained for the pipe-bends and across pipe sections like the elbow, T- joint, pipe reducer.
- It was found that the pressure loss decreases as a result of increasing volumetric flow rate. In addition, the pressure loss and pipe roughness (k) are inversely proportional with the pipe diameter.

References

- https://www.nuclear-power.net/nuclear-engineering/fluid-dynamics/major-head-loss-friction-loss/friction-factor-turbulent-flow-colebrook/
- https://www.pipeflow.com/pipe-pressure-drop-calculations/pipe-friction-loss


Thank You