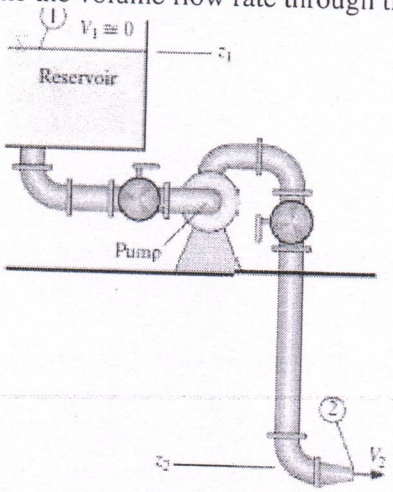
IV **Write an essay on ANY ONE of the following** **(1x10=10)**

1. Suppose the pump of Fig. is operating at *free delivery conditions*. The pipe, both upstream and downstream of the pump, has an inner diameter of 2.0 cm and nearly zero roughness. The minor loss coefficient associated with the sharp inlet is 0.50, each valve has a minor loss coefficient of 2.4, and each of the three elbows has a minor loss coefficient of 0.90. The contraction at the exit reduces the diameter by a factor of 0.60 (60% of the pipe diameter), and the minor loss coefficient of the contraction is 0.15. Note that this minor loss coefficient is based on the average *exit* velocity, not the average velocity through the pipe itself. The total length of pipe is 8.75 m, and the elevation difference is 4.6 m. Estimate the volume flow rate through this piping system.



2. Discuss the physical significance of the four nondimensional parameters in the nondimensionalized incompressible Navier-Stokes equation.

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KERALA AGRICULTURAL UNIVERSITY
B.Tech.(Food Technology) 2021 Admission
II Semester Final Examination – September 2022

Pafe.1207 **Fluid Mechanics (2+1)** **Marks: 50**
Time: 2 hours

I **Fill in the blanks** **(10x1=10)**

1. A ..... is the actual path traveled by an individual fluid particle over some time period.
2. The study of the motion of fluids that can be approximated as incompressible (such as liquids, especially water, and gases at low speeds) is usually referred to as .....
3. In fluids, stress is proportional to .....
4. The flow region adjacent to the wall in which the viscous effects (and thus the velocity gradients) are significant is called the .....
5. The densities of liquids are essentially constant, and thus the flow of liquids is typically .....
6. The highly ordered fluid motion characterized by smooth layers of fluid is called .....
7. Temperature is ..... property.

State True or False

8. A streamline is a curve that is everywhere tangent to the instantaneous local velocity vector.
9. A solid can resist an applied shear stress by deforming, whereas *a fluid deforms continuously under the influence of a shear stress*, no matter how small.
10. In equilibrium, the net force acting on the upper plate in the horizontal direction must be zero, and thus a force equal and opposite to F must be acting on the plate.

II **Write short notes on ANY FIVE of the following** **(5x2=10)**

1. Differentiate between mass and molar mass.
2. What is cavitation? What causes it?
3. Name four physical quantities that are conserved and two quantities that are not conserved during a process.
4. What are the three major assumptions used in the derivation of the Bernoulli equation?
5. List at least two common examples of fans, of blowers, and of compressors.
6. Give at least two reasons why turbines often have greater efficiencies than do pumps.
7. What is a draft tube, and what is its purpose?

III **Answer ANY FIVE of the following** **(5x4=20)**

1. Explain the relationship between vorticity and rotationality.
2. Briefly explain the similarities and differences between the material derivative and the Reynolds transport theorem.
3. Consider a device with one inlet and one outlet. If the volume flow rates at the inlet and at the outlet are the same, is the flow through this device necessarily steady? Why?
4. What is stagnation pressure? Explain how it can be measured.
5. How is the location of the hydraulic grade line determined for open-channel flow? How is it determined at the outlet of a pipe discharging to the atmosphere?
6. Is it possible for subcritical flow to undergo a hydraulic jump? Explain.
7. Define *net positive suction head* and *required net positive suction head*, and explain how these two quantities are used to ensure that cavitation does not occur in a pump.