INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR
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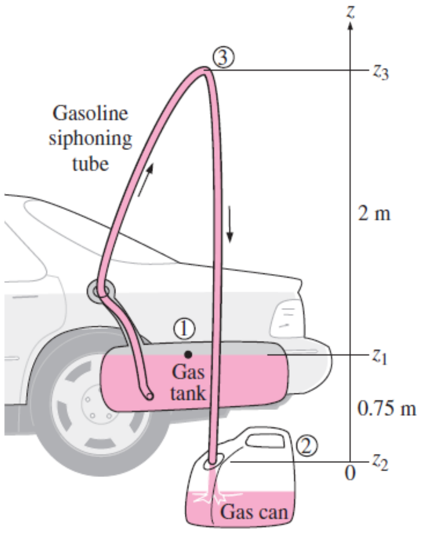
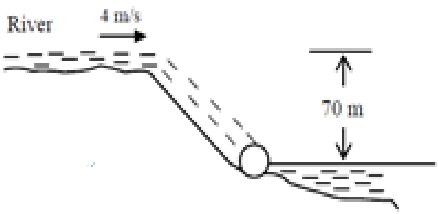
Department of Civil Engineering
Course: CE21003
Submission Deadline:
Total Marks:

Bernoulli's Equation

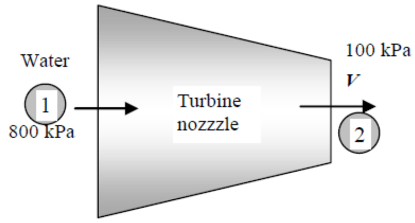
Q1) During a trip to the beach (P_{atm} =1 atm =101.3 kPa), a car runs out of gasoline, and it becomes necessary to siphon gas out of the car of a Good Samaritan (Fig.). The siphon is a small-diameter hose, and to start the siphon it is necessary to insert one siphon end in the full gas tank, fill the hose with gasoline via suction, and then place the other end in a gas can below the level of the gas tank. The difference in pressure between point 1 (at the free surface of the gasoline in the tank) and point 2 (at the outlet of the tube) causes the liquid to flow from the higher to the lower elevation.
Point 2 is located 0.75 m below point 1 in this case, and point 3 is located 2 m above point 1. The siphon diameter is 4 mm, and frictional losses in the siphon are to be disregarded. Determine (*a*) the minimum time to withdraw 4 L of gasoline from the tank to the can and (*b*) the pressure at point 3. The density of gasoline is 750 kg/m^3.



Q2) Consider a river flowing toward a lake at an average velocity of 4 m/s at a rate of 500 m^3/s at a location 70 m above the lake surface. Determine the total mechanical energy of the river water per unit mass and the power generation potential of the entire river at that location.



Q3) In a power plant, water enters the nozzles of a hydraulic turbine at a specified pressure (fig). Water enters the nozzle with a low velocity. Find the maximum velocity at exit of the nozzle. Absolute pressure are shown in figure.



Q4) Water flows at a rate of 0.035 m^3/s in a horizontal pipe whose diameter is decreased by a reducer. The pressures are measured before and after the reducer. Find the head loss in the reducer. The kinetic energy correction factors are given to be $\alpha_1 = \alpha_2 = \alpha = 1.05$.