PVP 20

Code: 20ME3301

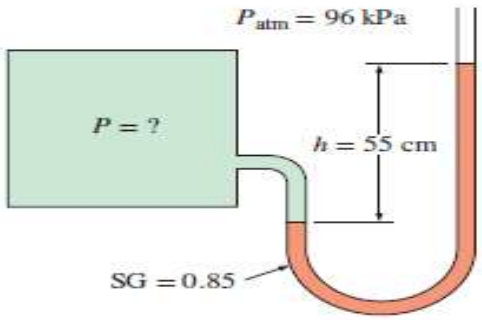
II B.Tech - I Semester – Regular/Supplementary Examinations
DECEMBER 2022

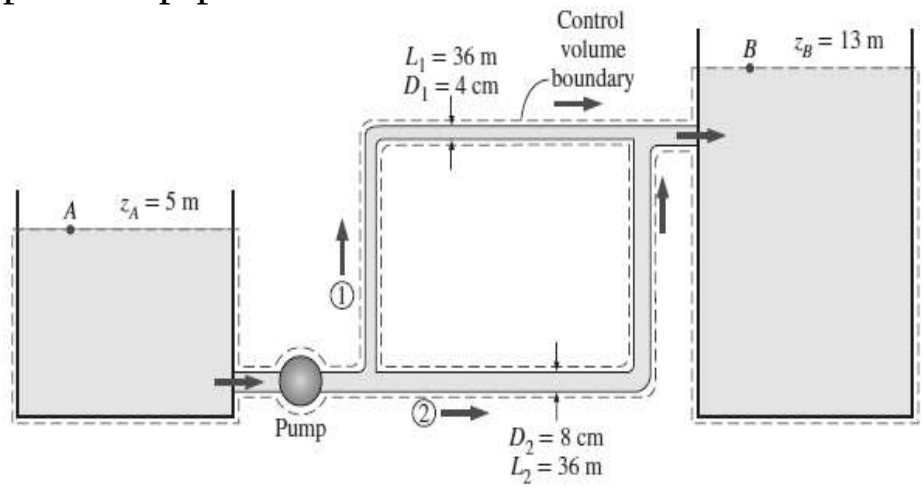
FLUID MECHANICS AND HYDRAULIC MACHINES
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

BL – Blooms Level CO – Course Outcome

			BL	CO	Max. Marks
UNIT-I					
1	a)	Determine the density, specific weight and specific volume of the oil (specific gravity = 0.8) in a tank whose dimensions are 4 m × 5 m × 6 m.	L2	CO1	7 M
	b)	A manometer is used to measure the pressure of a gas in a tank. The fluid used has a specific gravity of 0.85, and the manometer column height is 55 cm, as shown in figure below. If the local atmospheric pressure is 96 kPa, determine the absolute pressure within the tank. 	L2	CO1	7 M
OR					
2	a)	A 0.6-mm-diameter glass tube is inserted into water at 20°C in a cup. Determine the capillary rise of water in the tube. The surface tension of	L2	CO1	7 M

		water at 20°C is 0.073 N/m. The contact angle of water with glass is 0°.			
	b)	Determine the atmospheric pressure at a location where the barometric reading is 740 mm Hg and the gravitational acceleration is g = 9.81 m/s^2. Assume the temperature of mercury to be 10°C, at which its density is 13,570 kg/m^3.	L2	CO1	7 M
		UNIT-II			
3	a)	Derive the contonuity equation in three diamentional form.	L2	CO2	7 M
	b)	Water at 20°C is to be pumped from a reservoir (z_A = 5 m) to another reservoir at a higher elevation (z_B = 13 m) through two 36-m-long pipes connected in parallel, as shown in Fig. The pipes are made of commercial steel, and the diameters of the two pipes are 4 and 8 cm. Water is to be pumped by a motor–pump combination that draws 8 kW of electric power during operation. The minor losses and the head loss in pipes that connect the parallel pipes to the two reservoirs are considered to be negligible. Determine the total flow rate between the reservoirs and the flow rate through each of the parallel pipes. 	L2	CO2	7 M
		OR			

4	a)	What is the definition of a streamline? What do streamlines indicate? What is the definition of a streakline? How do streaklines differ from streamlines?	L2	CO2	7 M
	b)	A 300mm diameter pipe conveying water branches into two pipes of diameter 250mm and 200mm respectively. If the average velocities in the 300mm and 200mm pipes be 2.5m/s and 1 m/s. Calculate the velocity in the 250mm pipe.	L2	CO2	7 M
UNIT-III					
5	a)	With the help of a neat sketch explain the working of Pitot tube. How does the Pitot tube measure stagnation and static pressure?	L3	CO3	7 M
	b)	Obtain an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of the jet.	L3	CO3	7 M
OR					
6	a)	A Venturi meter equipped with a differential monometer is used to measure the flow rate of water at 15°C (= 999.1 kg/m^3) through a 5cm diameter horizontal pipe. The diameter of the Venturi neck is 3 cm and the deferential monometer shows a reading of 0.5m. Taking the discharge coefficient to be 0.98, determine the volume flow rate of water and the average velocity through the pipe.	L3	CO3	7 M
	b)	A jet of water of diameter 50 mm moving with a velocity of 20 m/s strikes a fixed plate in such a way that the angle between the jet and the plate is 60°. Find the force exerted by the jet on the pate (i) in the direction normal to the plate (ii) in the direction of the jet.	L3	CO3	7 M

UNIT-IV					
7	a)	Classify hydraulic turbines according to the type of energy available at the inlet of the turbines, direction of flow, head at inlet of the turbine and specific speed of the turbines.	L2	CO4	7 M
	b)	Define the specific speed of a turbine. Derive an expression for the specific speed. What is the significance of the specific speed?	L3	CO4	7 M
OR					
8	a)	What is the function of draft tube? What are the types of draft tubes? Define the efficiency of draft tube with an expression.	L2	CO4	7 M
	b)	Define the terms 'unit power', 'unit speed' and 'unit discharge' with reference to a hydraulic turbine. Also derive expressions for these terms.	L3	CO4	7 M
UNIT-V					
9	a)	What do you understand by characteristic curves of a pump? What is the significance of the characteristic curves?	L2	CO4	7 M
	b)	Describe the effect of variation of velocity in suction and delivery pipes of a reciprocating pump.	L2	CO4	7 M
OR					
10	a)	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.	L3	CO4	7 M
	b)	Define slip, percentage slip and negative slip of a reciprocating pump.	L2	CO4	7 M