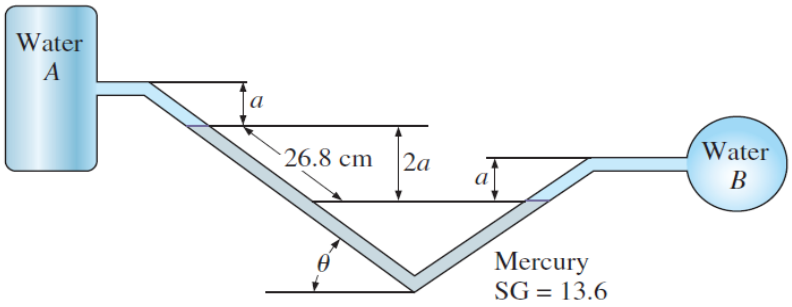
Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

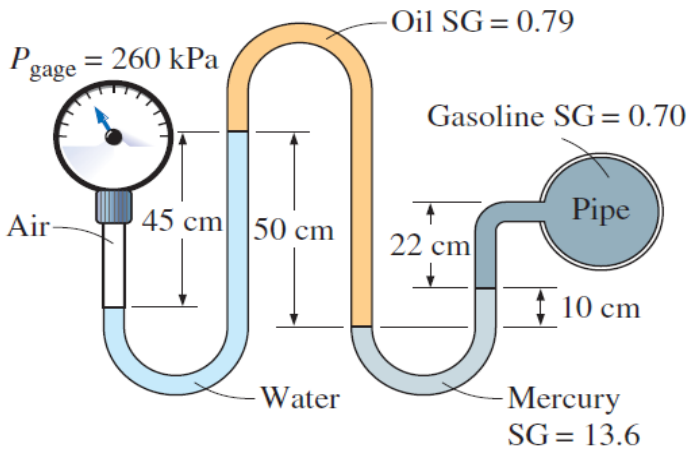
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Online End Semester Examination, Dec. 2020

Course: Fluid Mechanics in Petroleum Engineering — **Semester: III**
Program: B. Tech. APE - UP — **Time: 03 hrs.**
Course Code: PEAU 2005 — **Max. Marks: 100**

SECTION A

1. Each Question will carry 5 Marks
2. Instruction: Fill in the blanks or write short answers, where it is necessary. All questions are compulsory. Assume if any data missing.

S. No.	**Question**	**CO**
Q 1	Two water tanks are connected to each other through a mercury manometer with inclined tubes, as shown in Fig. 1. If the pressure difference between the two tanks is 20 kPa, Write the value of ***a*** = _____ and **θ** = _____.  Figure 1. Manometer with inclined tubes.	**CO1**
Q 2	A crane is used to lower weights into the sea (density = 1025 kg/m^3) for an underwater construction project. Determine the tension in the rope of the crane due to a rectangular 0.4 m × 0.4 m × 3 m concrete block (density = 2300 kg/m^3) when it is (a) suspended in the air and (b) completely immersed in water. Write the weight of concrete block in air is _____ and completely submerged in water is _____.	**CO2**
Q 3	A solid cylinder of diameter 4.0 m has a height of 4.0 m. Find the meta-centric height of the cylinder if the specific gravity of the material of cylinder = 0.6 and it is floating in water with its axis vertical. State weather the equilibrium is table or unstable. Write the value of meta-centric height_____.	**CO2**
Q 4	A horizontal venturimeter with inlet diameter 30 cm and throat diameter 15 cm is used to measure the flow of oil of sp. gr. 0.8. The discharge of oil through venturimeter is 50 litres/s, Take C_d = 0.98. Write the reading of the oil-mercury differential manometer (x) _____.	**CO3**

Q 5	Classify the losses of energy when a fluid is flowing through a pipe, the fluid experiences some resistances due to which some of the energy of fluid is lost.	**CO4**
Q 6	A gasoline line is connected to a pressure gage through a double-U manometer, as shown in Fig. 2. If the reading of the pressure gauge is 260 kPa. Write the gauge pressure of the gasoline line ($P_{gasoline}$) = _____.  Figure 2. Double-U manometer	**CO1**
SECTION B **1. Each question will carry 10 marks** **2. Instruction: All questions are compulsory. Assume if any data missing.**		
Q 7	Prove that the centre of pressure of a completely sub-merged plane surface is always below the centre of gravity of the sub-merged surface or at most coincide with the centre of gravity when the plane surface is horizontal.	**CO1**
Q 8	Find the density of metallic body which floats at the interface of mercury of sp. gr. 13.6 and water such that 40% of its volume is submerged in mercury and 60% in water.	**CO2**
Q 9	With the help of mathematical expression, prove that in case of vortex flow, the rise of liquid level at the ends is equal to the fall of liquid level at the axis of rotation.	**CO2**
Q 10	Two reservoir are connected by a pipe line of diameter 500 mm and length 3500 m. the difference of water level in the reservoir is 20 m. At a distance of 1000 m from the upper reservoir, a small pipe is connected to the pipe line. The water can be taken from the small pipe. Find the discharge to the lower reservoir, if (i) No water is taken from the small pipe, and (ii) 100 litres of water is taken from small pipe. Take f = 0.005 and neglect minor losses.	**CO4**
Q 11	Derive an expression to find the difference of water level in the two tanks if, (i) The water flow through pipes in series or flow through compound pipes	**CO4**

	(ii) Flow through parallel pipes **OR** At a sudden enlargement of a water main from 240 mm to 480 mm diameter, the hydraulic gradient rises by 10 mm. Estimate the rate of flow.	
SECTION C **1. Each Question carries 20 Marks.** **2. Instruction: All questions are compulsory. Assume if any data missing.**		
Q 12	Develop a relation to find maximum discharge for a broad-crested weir. A broad-crested weir of length 40 m, has 400 mm height of water above its crest. Take $C_d = 0.6$. (i) Find the maximum discharge and neglect velocity of approach. (ii) If the velocity of approach is to be taken into consideration, find the maximum discharge when the channel has a cross-sectional area of 40 m^2 on the upstream side. **OR** Derive an expressions for following if the viscous fluid flowing through a circular pipe and the viscous fluid flowing between two parallel plates. (i) Velocity distribution across a section. (ii) Ratio of maximum velocity to the average velocity. (iii) Drop of pressure for a given length	**CO3**