Reg. No.										

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III SEMESTER B.TECH. (AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, MARCH 2021

SUBJECT: FLUID MECHANICS [AAE 2159]

REVISED CREDIT SYSTEM
(12/03/2021)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

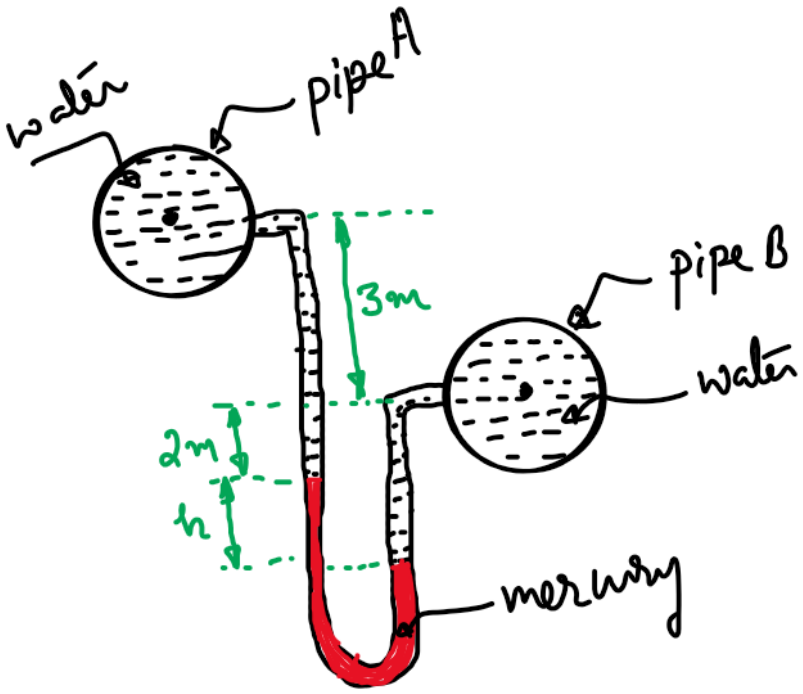
- Answer **ALL** the questions.
- Missing data may be suitable assumed.

1A. Dynamic viscosity of gases decreases with increase Temperature-True or False? Justify. **(02)**

1B. Define each of the following and give its unit i) specific gravity ii) specific volume iii) mass density. **(03)**

1C. A narrow gap of 3 cm width contains a thick oil (specific gravity=2 and dynamic viscosity=3 Pa.s). A think plate of 1 square meter surface area, and 0.5 cm thickness (weight =50N), is stuck in the middle of the gap in vertical orientation. If A man tries to pull that plate out of oil in vertical direction with constant velocity of 0.75 m/s, what is the minimum force he needs to apply ? **(05)**

2A. **(03)**



Water is flowing through two pipes A and B at pressure of 1 kgf/cm^2(in pipe A) and

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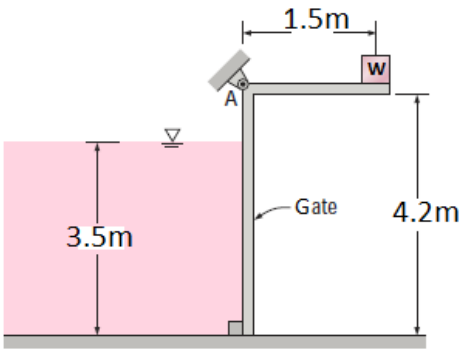
2 kgf/cm^2(in pipe B). A mercury differential manometer is connected between two pipes as shown in the figure. Find the difference in the level of mercury(h) in the manometer.

2B. Find the height of the building if pressure meaured at the top of builing and bottom of the building are 750 mm of mercury and 760 mm of mercury respectively. Density of air near the building is uniform and equal to 1.1 kg/m^3 **(03)**

2C. For a incompressible, steady state fluid flow show that, **(04)**

$$\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}+\frac{\partial w}{\partial z}=0$$

3A. A weight W is holding a L shaped gate against the force of water in a reservoir. It is desired that gate opens (by rotating about hinge A) when the level of water in reservoir is 3.5 m. What is the weight W needed to achieve this? Width of the gate is 1.8 m. **(04)**



3B. A rectangular wooden block 10 m long, 7 m broad and 2.5 m deep weighs 687.7 kN. It carries a cylinder of 5 m diameter weighing 588.6 kN over it (axis of the cylinder and axis of the wooden block being parallel). The combination floats in seawater with axes being perpendicular to the plane of the paper. Find the meta centric height. (assume density of sea water to be 1030 kg/m^3). **(03)**

3C. Following equation represents two components of velocity of a steady incompressible flow. Find the third component. **(03)**

$$v = 2y^2,\quad w = 2xyz$$

4A. Find the density of the stone, which floats at the interface of water and mercury such that 40% of the volume is inside mercury. **(02)**

4B. A long inclined pipe whose one end, A is 500 mm in diameter lying at distance of 4m above other end B which has a diameter of 200 mm. Pressure measured at A and B are 5.89 N/cm^2 and 9.81 N/cm^2 at end A and B respectively. An oil of specific gravity 0.87 flows through it at a discharge of 200 litre/sec. find, if flow is from A to B or B to A. **(04)**

4C. A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of water through a pipe. The pressure at the inlet of the pipe **(04)**

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is 17.66 N/cm^2 and the pressure at the throat is 30cm mercury (vacuum). Find the actual discharge of water through the pipe (C_d=0.98)

5A. Show that the pressure difference ∇P in a pipe of diameter D and length L due to viscous flow through it depends on the velocity V, viscosity μ and density ρ is given by **(04)**

$$\nabla P = \frac{\mu V}{D} \; f\left(\frac{L}{D}, \frac{\rho DV}{\mu}\right)$$

5B. Express Reynold's number, Froude's number and Euler's number as ratio of forces acting on flowing fluid. Give formula for each. **(03)**

5C. With a neat sketch explain the development of boundary layer over a flat plate **(03)**