Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

III SEMESTER B.TECH. (AERONAUTICAL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2019

SUBJECT: FLUID DYNAMICS [AAE 2156]

REVISED CREDIT SYSTEM
(28/11/2019)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A. A fluid, which weighs 21Newton, measures 2.5 litres. Find i) Mass density ii) Weight density iii) Specific gravity and iv) Specific volume **(02)**

1B Explain the dependence of dynamics viscosity with temperature for liquids and gases. **(03)**

1C A vertical gap of 2.2cm wide contains a fluid(S=0.9) of viscosity 2Pa-s. A metallic plate of surface area 1.2mX1.2m and thickness 0.2cm is to be lifted vertically through the gap at a constant velocity of 0.15m/s. If plates weighs 40N, what is the minimum force required to lift the plate? **(05)**

2A

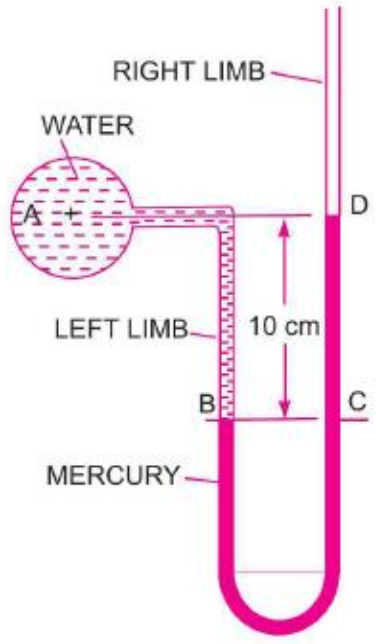

Figure 1

For the figure 1 shown above find the pressure of water inside the pipe. **(04)**

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

If the pressure inside the pipe is reduced to 9.81 kPa, what will be the new difference of mercury level inside the manometer?

2B

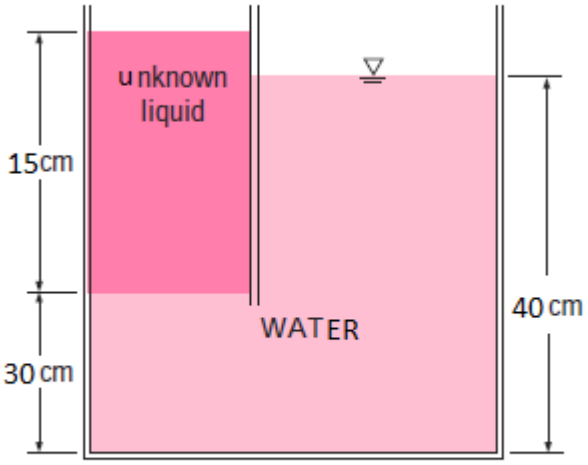

Figure 2

Find the density of the unknown liquid for the case shown in the figure 2 above. **(02)**

2C Derive an expression for continuity for 3 dimensional, compressible, unsteady fluid flow. **(04)**

3A Flow of water from a reservoir is controlled by 6 feet wide L shaped gate hinged at A as shown in the figure 3. If it is desired that gate opens when water height is 12 feet, determine the weight (W) required.

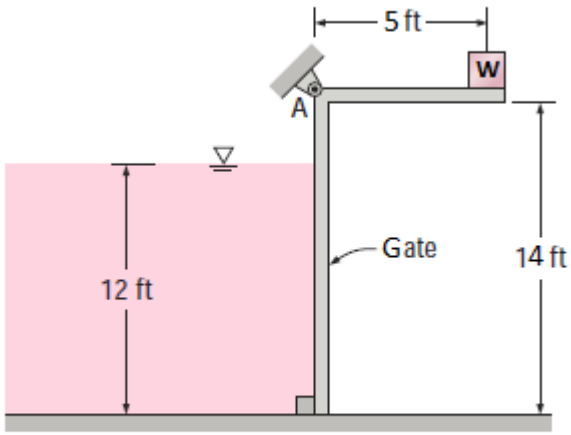

Figure 3

(04)

3B A rectangular wooden block 10m long, 7 m broad and 2.5 m deep weighs 687.7kN. It carries a cylinder of 5m diameter weighing 588.6kN over it (axis of the cylinder and **(04)**

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

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).

3C 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)**

4A Define velocity potential function and stream function. **(02)**

4B A pipeline carrying oil of specific gravity 0.87, changes its diameter from 200mm diameter at a position A to 500mm diameter at a position B which is 4 meters higher than A. If the pressure at A and B are 9.81N/cm^2 and 5.886N/cm^2 respectively and the discharge is 200litres/sec, determine the loss of head and direction of flow. **(04)**

4C A horizontal venturimeter with inlet diameter 20cm and throat diameter 10cm is used to measure the flow of water through a pipe. The pressure at the inlet of the pipe is 17.66N/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) **(04)**

5A Using Buckingham's π theorem , show that discharge Q consumed by an oil ring is given by

$$Q = Nd^3 \phi\left[\frac{\mu}{\rho N d^2}, \frac{\sigma}{\rho N^2 d^3}, \frac{w}{\rho N^2 d}\right]$$

Where d is internal diameter of the ring, N rotational speed, ρ is density,μ is dynamic viscosity, σ is surface tension and w is specific weight of the oil. **(04)**

5B What is geometrical, kinematic and dynamic similarity with respect to model testing? **(03)**

5C With a neat sketch , explain boundary layer phenomenon **(03)**