Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

A Constituent Institute of Manipal University, Manipal

IV SEMESTER B.TECH (MECHANICAL ENGG.) END SEMESTER EXAMINATIONS, JUNE 2017

SUBJECT: FLUID MECHANICS [MME 2202]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A. Classify the various types of fluids with the help of a diagram and briefly explain them. **2**

1B. An oil film of thickness 1.5 mm is used to for lubrication between a square plate of size 0.9 m x 0.9 m and an inclined plane having an angle of inclination 20^o with the horizontal. The weight of the square plate is 392.4 N and it slides down the plane with a uniform velocity of 0.2 m/s. Find the dynamic viscosity of oil. **3**

1C. State and prove hydrostatic law. **2**

1D. The measurements of pressure at the base and top of a mountain are 74 cm and 60 cm of mercury respectively. Calculate the height of the mountain if air has a mass density of 1.22 kg/m^3. **3**

2A. A rectangular sluice gate AB, 2 m wide and 3 m long is hinged at A as shown in Fig. Q (2A). It is kept closed by a weight fixed to the gate. The total weight of the gate and weight fixed to the gate is 343350 N. Find the height of the water 'h' which will just cause the gate to open. The center of gravity of the weight and gate is at G. **4**

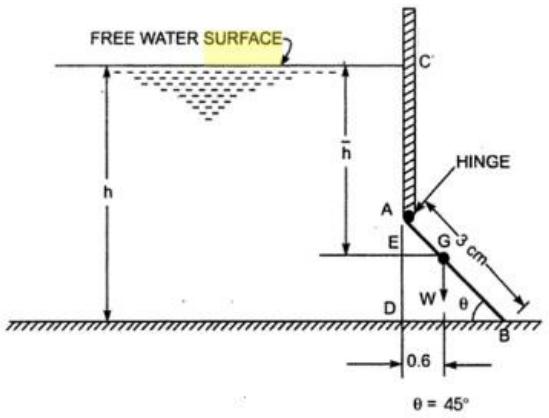

Figure Q(2A)

2B. A cylinder 3 m in diameter and 4 m long retains water on one side. The cylinder is supported as shown in the Fig Q (2B). Determine the horizontal reaction at A and the vertical reaction at B. The cylinder weighs 196.2 kN. Ignore friction. **2**

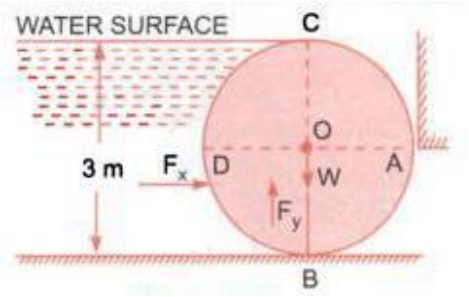

Figure Q(2B)

2C. Show that a cylindrical buoy of 1 m diameter and 2 m height weighing 7.848 kN will not float vertically in sea water of density 1030 kg/m^3. Find the force necessary in a vertical chain attached at the centre of base of the buoy that will keep it vertical. **4**

3A. In a compressible flow, the velocity vector is given by $V = (6xt + yz^2)i + (3t+ xy^2)j +(xy-2xyz-6tz)k$ **3**

i) Verify whether continuity equation is satisfied

ii) Determine the acceleration vector at point L (2,2,2) at t = 2

3B. Sketch and derive the velocity and shear stress profile for flow between parallel plates that are fixed. **3**

3C. A pipe line carrying oil (specific gravity 0.8) changes in diameter from 300 mm at position 1 to 600 mm diameter at position 2 which is 5m at higher level. If the pressures at position 1 and 2 are 100KN/m^2 and 60KN/m^2 respectively and the discharge is 300 litres/sec, determine **4**

a) Loss of head

b) Direction of flow

4A. 1:6 scale model automobile is tested in a wind tunnel in the same air properties as of prototype. The prototype velocity is 48 km/hr. For dynamic similarity conditions, model drag is 320 N. What is the drag of the prototype automobile and power required to overcome this drag? **5**

4B. Explain Raleigh's method of dimensional analysis with an example and discuss its limitations. **5**

5A. Derive and expression for the loss of head due to (i) sudden enlargement and (ii) sudden contraction of a pipe. **4**

5B. A horizontal pipe of diameter 500 mm is suddenly contracted to a diameter of 250 mm. The pressure intensities in the large and smaller pipe is given as 13.734 N/cm^2 and 11.772 N/cm^2 respectively. Find the head loss due to contraction if $C_c = 0.62$. Also determine the rate of flow of water. **3**

5C. What do you understand by (i) total drag on a body (ii) resultant force on a body (iii) coefficient of drag and coefficient of lift? **3**