Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

A Constituent Institute of Manipal University, Manipal

IV SEMESTER B.TECH (MECHANICAL ENGG.) END SEMESTER EXAMINATIONS, APRIL/MAY 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. Calculate the capillary effect in mm in a glass tube of 4 mm diameter, when immersed in Hg. The temperature of liquid is 20°C and surface tension of Hg at 20°C in contact with air is 0.51 N/m. Angle of contact is 130°. (Specific gravity of Hg is 13.6). **3**

1B. Define the following properties of fluid: (i) Density (ii) Specific Volume (iii) Specific gravity (iv) Kinematic viscosity **2**

1C. The right limb of a simple U-tube manometer containing Hg is open to atmosphere while the left limb is connected to a pipe in which a fluid of specific gravity 0.9 is flowing. The centre of the pipe is 12 cm below the level of Hg in the right limb. Find the pressure of fluid in the pipe if the difference of Hg level in the two limbs is 20 cm. **3**

1D. State and prove Pascal's law. **2**

2A. Find an expression for the force exerted and center of pressure for a completely submerged inclined plane surface. Can the same method be applied for finding the resultant force on a curved surface immersed in the liquid? If not, why? **4**

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

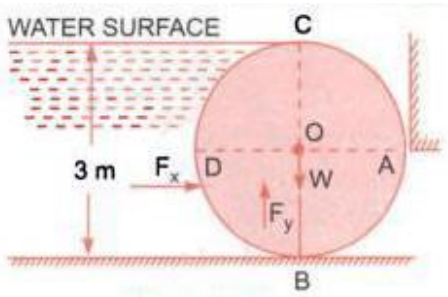

Figure Q (2B)

2C. A cone of specific gravity S, is floating in water with its apex downwards. It has a diameter D and vertical height H. Show that for stable equilibrium of the cone, $H < \frac{1}{2}\left[\frac{D^2.S^{1/3}}{2-S^{1/3}}\right]^{1/2}$ **4**

3A. Define the following : (a) Steady and unsteady flow (b) Uniform and non-uniform flow (c) One and two dimensional flow (d) Rotational and irrotational flow (e) Laminar and turbulent flow. **3**

3B. Sketch and derive the Hagen Poiseiulle equation for flow of viscous fluid through a circular pipe. **3**

3C. A pipe 200m long slopes down at 1 in 100 and tapers from 600mm diameter at a higher end to 300mm diameter at the lower end and carries 100litres/sec of oil (specific gravity 0.8). If the pressure gauge at the higher end reads 60KN/m^2, determine: **4**

(a) Velocities at the two ends.

(b) Pressure at the lower end. Neglect losses.

4A. The size of droplets produced by a liquid spray nozzle is thought to be depending upon nozzle diameter D, jet velocity v, and properties of liquid namely density ρ, viscosity μ, and surface tension σ. Rewrite this relation in dimensionless form. **5**

4B. Explain the concept of dimensional homogeneity with the help of an example. **2**

4C. Discuss the requirements for accurate fluid mechanical testing of models, such as models of aircraft and cars. What are the practical limitations? Use dimensionless parameters to help explain and highlight its significance. **3**

5A. A horizontal pipeline 40 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25 m of its length from the tank, the pipe is 150 mm diameter and its diameter is suddenly enlarged to 300 mm. The height of the water level in tank is 8 m above the centre of the pipe. Considering all losses of head which occur, determine the rate of flow. Take f = 0.01 for both sections of the pipe. Draw HGL and TEL. **5**

5B. Find an expression for the power transmission through pipes. What is the condition for maximum transmission of power and corresponding efficiency of transmission? **3**

5C. Differentiate between (i) stream line body and bluff body (ii) Friction drag and pressure drag. **2**