Roll No. ....
Printed Pages : 3

9418

BT-4/M-17
FLUID MECHANICS
Paper—ME-208 N

Time allowed : 3 hours]　　　　[Maximum marks : 75

Note :-　　Attempt five questions, selecting at least one question from each unit. Assume any missing data suitably.

Unit-I

1. (i) Define the concept of continuum. 　　　　4

   (ii) What is viscosity? What are its causes? 　　4

   (iii) A 150 mm diameter shaft rotates at 1500 rpm in a 200 mm long journal bearing with 150.5 mm internal diameter. The uniform annular space between the shaft and the bearing is filled with oil of dynamic viscosity 0.8 poise. Calculate the power dissipated as heat. 　　　　7

2. A cylinder having 3 m diameter and 1.5 m length is resting on the floor. On one side, water is filled upto half the depth while on the other side oil of relative density 0.8 filled upto the top. If the weight of the cylinder is 33.75 kN, determine the magnitude of the horizontal and vertical components of the force which will keep the cylinder just touching the floor. 　　　　15

Unit-II

3. Derive the three dimensional continuity equation in polar coordinates. 　　　　15

9418　　　　　　　　　　　　　　　　[Turn over

(2)

4. The following data relate to an inclined venturimeter: 　　15

   Diameter of the pipeline = 400 mm

   Inclination of the pipeline with the horizontal = 30^0

   Throat diameter = 200 mm

   The distance between the mouth and throat of the meter = 600 mm

   Specific gravity of oil flowing through the pipeline = 0.7

   Specific gravity of manometric fluid = 13.6

   Reading of the differential manometer = 50 mm

   The coefficient of the meter = 0.98

   Determine the rate of flow in the pipeline.

Unit-III

5. A pipe 60 mm diameter and 450 m long slopes upwards 1 in 50. An oil of viscosity 0.9 Ns/m² and specific gravity 0.9 is required to be pumped at the rate of 5 litres per sec. 　　15

   (i) Is the flow laminar?

   (ii) What pressure difference is required to attain this condition?

   (iii) What is the power of the pump required assuming an over efficiency of 65%?

   (iv) What is the centre-line velocity and the velocity gradient at pipe wall?

6. Two sharp ended pipes of diameters 50 mm and 100 mm respectively, each of length 100 m respectively, are connected in parallel between two reservoirs which have a difference of level

9418

(3)

of 10m. If the friction factor for each pipe is 0.32, calculate:

(i) Rate of flow for each pipe

(ii) The diameter of a single pipe 100 m long which would give the same discharge, if it were substituted for the original two pipes. 15

Unit-IV

7. Explain the characteristics of growth of the boundary layer over a flat plate. Also define displacement thickness, momentum thickness and energy thickness along with their physical significance. 15

8. (i) What are streamlined and bluff bodies? 6

   (ii) A kite weighing 9.8 N and having an area 1 m² makes an angle of 7° to horizontal when flying in a wind of 36 km/h. If pull on the string attached to the kite is 49 N and it is inclined to horizontal at 45°, calculate the lift and drag co-efficients. Take density 1.2 kg/m³ for air. 9

9418