Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐ **Total No. of Pages : 3**

Total No. of Questions : 09

B.Tech. (IE) (Sem.–4) (2008 Batch)

B.Tech. (ME) (Sem.–4)

FLUID MECHANICS-I

Subject Code : ME-206

Paper ID : [A0810]

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTION TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students has to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students has to attempt any TWO questions.**

SECTION-A

1. Write briefly :

(a) Explain surface tension phenomenon.

(b) What is Pascal's law and what are its Engineering applications?

(c) Define metacentre and metacentric height. How is the metacentric height related with the time period of oscillation?

(d) What is a stream function and what are its characteristics?

(e) Define 1D-, 2D- and 3D- flows? Give examples.

(f) What is angular momentum equation and what are its applications?

(g) Differentiate free and forced vortex motions.

(h) What are the characteristics of dimensionally homogenous equations?

(i) How are the flow regimes studied by Reynolds?

(j) What is a mouthpiece and what are the various types of mouthpieces?

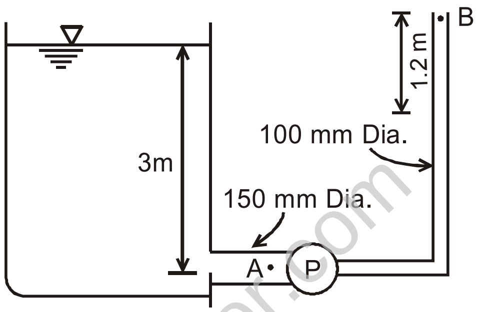
SECTION-B

2. A piston of 59 mm diameter is rotating inside a 60 mm diameter cylinder. Both the cylinder and piston are 80 mm long. The space between the cylinder and piston is filled with oil of viscosity 0.3 kg/ms. If a torque of 1.5 Nm is applied, find the rpm of piston and the power required.

3. A differential U-tube manometer containing mercury is connected to an inclined pipe making an angle of 30° with horizontal. The distance between the gauge points along length of the pipe is 5 m. Determine (i) manometer reading if there is no flow and (ii) differential pressure if manometer reading is 50 mm and the flow is upward.

4. A (4 m × 4 m) inclined gate *PQ* making an angle of 45° with horizontal is provided at the bottom of an oil tank containing gasoline of specific gravity 0.70. The top edge *P* of gate is hinged and the level of gasoline above the top edge is 2 m. The top surface of gasoline is subjected to a vacuum pressure of 6865 N/m^2. Determine the vertical pull to be applied at the lower edge *Q* to open the gate.

5. Figure 1 shows a pump *P* pumping 60 litres per sec of water from a tank. Determine :
   (i) pressure at points *A* and *B* when pump delivers 10 kW of power to the flow (neglect losses)
   (ii) pressure at point *B*, when the loss from inlet to the pump is negligible and from pump to point *B* is 2 times the velocity head at *B*.



6. A 300 mm diameter pipe carries water under a head of 20 m with a velocity of 3.5 m/s. If axis of the pipe turns 45°, find the magnitude and direction of the resultant force at the bend.

SECTION-C

7. A pipe converges linearly from 800 mm to 400 mm over a length of 1.5 m. The discharge through the pipe is 100 litres per sec. Determine the total acceleration at the middle of pipe. If discharge through the pipe now increases uniformly from 100 litres per sec to 200 litres per sec in 40 sec, determine the total acceleration at the middle of pipe after 20 sec.

8. A small flow meter is designed to measure gas flow in 12.5 mm diameter gas pipeline. For a discharge of 0.004 m^3/s, pressure drop across the meter is expected to be 4.8 kPa. An enlarged geometrically similar model is to be tested in a 300 mm diameter water pipe. Determine discharge and pressure drop in the model. Given: density and viscosity of gas as 12 kg/m^3 and 18×10^{-6} Ns/m^2, respectively and that of water as 1000 kg/m^3 and 11.7×10^{-4} Ns/m^2.

9. The rate of flow of water pumped into a pipeline ABC is 0.02 m^3/s. The pipe is laid on an upward slope of 1 in 40. The length AB of the pipe is 100 m and its diameter is 100 mm, while the length BC of pipe is also 100 m but its diameter is 200 mm. The change of diameter at B is sudden. The end C of pipe is connected to a tank. If pressure at A is 196.2 kPa, determine pressure at C. Also, draw HGL and TEL. Given, coefficient of friction = 0.008.