

Roll No.

Total No. of Pages : 02

Total No. of Questions : 09

B.Tech (ME) (Sem.-4)/
B.Tech (IE) (Sem.-4)(2008 Batch)
FLUID MECHANICS-I
Subject Code : ME-206
Paper ID : [A0810]

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTION TO CANDIDATES :

1. SECTION-A is COMPULSORY.
2. Attempt any FOUR questions from SECTION-B.
3. Attempt any TWO questions from SECTION-C.

SECTION-A (10 × 2 = 20 Marks)

1. a) Distinguish between surface tension and capillarity.
b) Explain why the fluid mass under constant linear acceleration is equivalent to a fluid mass at rest?
c) How do you determine the acceleration of a fluid particle?
d) What is kinetic energy correction factor and what is its significance?
e) Distinguish between free and forced vortex motions.
f) What are distorted models and how do you determine the discharge scale ratio of these models?
g) What is an equivalent pipe and how is its diameter determined?
h) Show that velocity distribution for laminar flow in a pipe is parabolic.
i) Write a note on a differential manometer.
j) What is a weir and how are weirs classified?

SECTION-B (4 × 5 = 20 Marks)

2. A thin plate of surface area A is placed mid-way in a gap of height h , filled with a liquid of viscosity μ_1 . The gap is then filled with another liquid of viscosity μ_2 and the same plate is now placed at a distance of $h/4$ from one of the walls. Determine a relationship between μ_1 and μ_2 for the same viscous resistance on the plate.
3. A trapezoidal channel of bottom width 2 m and depth 1 m has side slopes 1:1. Determine the total pressure and its location on a vertical gate closing the channel when it is full of water.

4. A 2 m long pipe tapers uniformly from 100 mm diameter to 200 mm diameter at its upper end. The centre of pipe slope upwards at an angle of 30° to the horizontal and the flow of water is from smaller section to bigger section. If pressures at the smaller and bigger sections are 200 and 230 kPa, respectively, determine discharge and water pressure at the mid-length of pipe. Neglect losses.
5. A jet of oil of specific gravity 0.85 issues from a nozzle of 150 mm diameter with a velocity of 12 m/s. A smooth cone with vertex angle 90° deflects the jet. The jet is horizontal and the vertex of the cone points towards the jet. Calculate the force required to hold the cone in position.
6. Determine the difference in elevation between the water surfaces in the two tanks which are connected by a horizontal pipe of diameter 300 mm and length 400 m. The rate of flow of water through the pipe is $0.3 \text{ m}^3/\text{s}$. Also, draw HGL and TEL. Given, coefficient of friction = 0.008.

SECTION-C

(2 × 10 = 20 Marks)

7. The difference in levels between the catchment and service reservoir of a town supply is 180 m and the distance between them is 50 km. The reservoirs were originally connected by a single pipe designed to carry 275 litres per second. It was later found necessary to increase the flow to 400 litres per sec and it was decided to lay another pipe of same diameter along side the first, over part of the length. Calculate (i) diameter of the pipes and (ii) length of second pipe. The friction factor of old pipe is 0.03 and the new pipe is 0.02.
8. The discharge Q over a weir depends upon head H , kinematic viscosity ν , mass density ρ , surface tension σ and acceleration due to gravity g . Derive a relationship among the variables using method of dimensional analysis.
9. A nozzle attached to the end of a 100 mm diameter pipe has 30 mm diameter at the other end. If nozzle issues a jet of water of velocity 25 m/s into atmosphere, calculate the pressure at the base of nozzle. The coefficients of velocity and contraction for the nozzle can be taken as 0.96 and 0.98, respectively.