Roll No. ....

Total No. of Questions : 09] **[Total No. of Pages : 02**

B.Tech.(Sem. – 3rd/4th)

FLUID MECHANICS - I

SUBJECT CODE : ME – 206 (2008 Batch)

Paper ID : [A0810]

Time : 03 Hours **Maximum 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

Q1) ***(10 × 2 = 20)***

a) Discuss the classification of fluids.

b) Explain hydrostatic paradox.

c) Define the three equilibrium conditions of stability of submerged bodies.

d) What are the different methods of describing fluid motion?

e) What is kinetic energy correction factor and what is its significance?

f) State Bernoulli's equation. How would you modify this equation for different flow situations?

g) What is dimensional homogeneity and what are the characteristics of dimensionally homogeneous equations?

h) Explain minor losses of energy in pipelines.

i) Describe Reynolds experiment for the existence of two types of flow viz. laminar and turbulent.

j) How do you determine differential pressure in a horizontal pipeline using water-mercury manometer?

Section - B

(4 × 5 = 20)

Q2) A 90 mm diameter shaft rotates at 1200 rpm in a 100 mm long journal bearing of 90.5 mm internal diameter. The annular space in the bearing is filled with oil having viscosity of 0.12 Pa.s. Estimate power dissipated in the bearing.

Q3) An object which has a volume of 0.18 m^3 requires a force of 270 N to keep it immersed in water. If 160 N force is required to keep it immersed in another liquid, determine specific gravity of this liquid.

Q4) The velocity distribution at any section along a vertical between two horizontal plates distance 4 m apart varies as: at quarter distances from the ends, velocity varies from 0 to 4 m/s and in the middle half portion; velocity is constant and is equal to 4 m/s.Determine momentum correction factor.

Q5) A horizontal jet of water of diameter 75 mm moving with a velocity of 25 m/s strikes a fixed plate inclined at 60° to the jet. Find the force exerted on the plate.

a) In the direction normal to the plate and

b) In the direction of jet.

Q6) A convergent-divergent mouthpiece is fitted into the vertical side of a tank containing water. The minimum absolute pressure at the throat is 2.45 m of water. Determine throat and exit diameters of mouthpiece to discharge 0.425 litres per sec for a head of 1.524 m on the mouthpiece. Assume no losses in the convergent part and losses in divergent part are 0.18 times the velocity head at exit of mouthpiece.

Section - C

(2 × 10 = 20)

Q7) A pump is used to lift an oil of specific gravity 0.90. The pressures on the suction and discharge sides of the pump as read by the pressure gauges are: 25 cm of mercury vacuum and 140 kN/m^2, respectively. The suction gauge is placed 600 mm below the center line of pump whereas the gauge on the discharge side is placed 170 mm above the centerline. If diameters of pipes on the suction and discharge sides are 150 and 100 mm, respectively and the quantity of oil to be lifted is 30 liters per second, calculate power supplied by the pump. Assume efficiency of the pump as 70%.

Q8) Resistance R to the motion of a completely submerged body depends on length of body L, velocity of flow V, mass density ρ and kinematic viscosity v. Determine a relationship for R using dimensional method of analysis. Further, if resistance of a 1/8 scale aircraft model when tested in water at 12 m/sec is 215 N, what will be the resistance in air of the aircraft model at the corresponding speed? The kinematic viscosity of air is 13 times that of water and density of water is 810 times that of air.

Q9) Derive Darcy's equation for head loss due to friction for flow in pipes. How is the value of Darcy's friction factor determined for laminar and turbulent flows?