(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2124 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. V) ODD SEMESTER THEORY EXAMINATION 2012–13

FLUID MECHANICS

Time : 2 Hours *Total Marks : 50*

Note :– Attempt **all** questions. Assume any data not given suitably.

1. Attempt any **four** parts of the following. All parts carry equal marks : **(3×4=12)**

   (a) Explain the methods of drawing flow nets.

   (b) Define stream line, streak line and path line.

   (c) Define buoyancy. Discuss the stability of immersed and floating bodies.

   (d) A 90 N rectangular solid block slides down a 30° inclined plane. The plane is lubricated by a 3 mm thick film of oil of relative density 0.90 and viscosity 8.0 poise. If the contact area is 0.3 m^2, estimate the terminal velocity of the block.

   (e) Explain the working of a single-tube manometer. What is the advantage of a single-tube manometer over an ordinary manometer ?

   (f) The lower corner of a water tank has the shape of a quadrant of a circle of radius 1.2 m. The water surface is 2.4 m above the centre of curvature. The water tank is 3.0 m long. Find the magnitude, direction and location of the total force exerted by the water surface on this curved surface.

2. Attempt any **two** parts of the following. All parts carry equal marks : **(6.5×2=13)**

(a) A 7.5 cm diameter water jet having a velocity of 12 m/s impinges on a plane, smooth plate at an angle of 60° to the normal to the plate. What will be the impact when the plate is (i) Stationary and (ii) Moving in the direction of the jet at 6 m/s. Estimate the work done per unit time on the plate in each case.

(b) (i) Write down Bernoulli's equation and explain its applications.

(ii) Write short note on 'Flow through porous media'.

(c) What is Stoke's law ? Calculate the diameter of a vertical pipe needed for flow of a liquid at a Reynolds number of 1200 when the pressure remains constant throughout the pipe. Kinematic viscosity of fluid $v = 1.92 \times 10^{-3}$ m²/s.

3. Attempt any **two** parts of the following. All parts carry equal marks : **(6.5×2=13)**

(a) What do you understand by 'hydraulic similitude' ? The drag force F_D on a sphere in laminar flow is known to depend on its diameter D, velocity of flow V, density of fluid e and the coefficient of visocity μ. Obtain an expression of F_D by Raleigh's method.

(b) Write short notes on following :

(i) Flow between parallel plates

(ii) Model studies

(iii) Eddy viscocity.

(c) Experiments were conducted in a wind tunnel with a wind speed of 50 km/h on a flat plate of size 2 m long and 1.2 m wide. The density of air is 1.20 kg/m^3. The plate is kept at an angle and the coefficient of lift and drag are 0.75 and 0.15 respectively. Determine :

(i) Lift force

(ii) Drag force

(iii) Resultant force and

(iv) Power expended in overcoming resistance of the plate.

4. Attempt any **four** parts of the following. All parts carry equal marks : **(3×4=12)**

(a) Differentiate between smooth and rough surfaces.

(b) Describe the concept of equivalent length.

(c) Explain the transmission of pressure waves in rigid pipe.

(d) A 6 cm diameter pipe has a discharge of 450 L/min. At a section the pipe has a sudden expansion to a size of 9 cm diameter. If the pressure just upstream of the expansion is 20 kN/m^2, calculate the pressure just after the expansion. Assume the pipe to be horizontal at the expansion region.

(e) What do you mean by 'resistance coefficient' ? Discuss its variation.

(f) What is Siphon ? Explain flow through siphon.