Fifth Semester B. E. (Civil) Examination

FLUID MECHANICS I

Time : Three Hours] [Max: Marks : 80

N. B. : (1) Four questions carry 13 marks and two questions carry 14 marks.
(2) Due credit will be given to neatness and adequate dimensions.
(3) Assume suitable data wherever necessary.
(4) Illustrate your answers wherever necessary with the help of neat sketches.
(5) Use of Non–programmable calculator is permited.
(6) Solve all questions. Each question given choice in the form of (OR).

1. (a) Express the dimensions of dynamic and kinematic viscosities in terms of– force, length and time, and explain the effect of temperature on viscosity. 6

(b) A bush of 165 mm length and of 103 mm internal diameter slides on a vertical column of 100 mm dia., the clearance space being filled with oil. If a 35.00 N bush mass slides with a velocity of 1.00 m/sec, determine the dynamic viscosity of oil. 7

OR

(a) Define with neat sketch :—

(i) Piezometer.

(ii) Inverted U–Tube manometer.

(iii) Micromanometer. 6

(b) In a horizontal pipeline carrying oil of specific gravity 0.85, the pressure difference between two points is recorded by a manometer. If the manometer is as per fig. 1, Using air as the indicating fluid, calculate the pressure difference when the difference is menisci of oil is 10 cm.

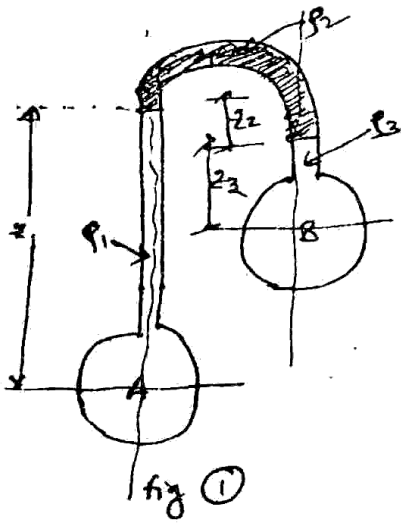

fig (1) 7

3. (a) Explain Buoyant force and Archemedis principle. 6

(b) Derive the analytical determination of metacentric height. 7

OR

4. (a) Define with sketch :—

(i) Absolute pressure.

(ii) Gauge pressure.

(iii) Metacentre. 6

(b) The vertices A, B, C, of a triangular lamina lie 0.5 m, 0.75m, and 1.75 m below the free water surface. If AB = 3.5 m. BC = 2.5m, CA=3m, find the thrust on one face of the lamina. 7

5. (a) Explain the terms :—

(1) Stream line.

(2) Streak line.

(3) Path line. 5

Contd

(b) What does the smoke emitting from a jet plane represent, stream line or pathline or streakline ? Why ? 4

(c) Compare between uniform flow and Non–uniform flow. 4

OR

6. (a) What is a flow net ? What are its uses ? Give examples. 6

(b) The velocity potential for a two diamensional flow field is given by $\phi = x^2 - y^2$. Calculate the components of velocity and the velocity at (1, 2). Find also the stream function. 7

7. (a) Starting from steady flow energy equation, show how Bernoulli's equation for an inviscid incompressible fluid can be obtained. 6

(b) A 500 m long pipe has a slope of 1 in 100 tapers from 1 m. dia at higher end to 0.5 m.dia at lower end. It carries an oil of sp.gr. 0.85 at a rate of 100 lit/s. If the pressure at high end is 250 kN/m^2 find the pressure at the lower end. Neglect friction. 7

OR

8. (a) Derive on expression for the volumetric flow rate of a fluid flowing through an orifice meter. Write the assumptions made for it. 6

(b) A vertical venturimeter measures the flow of oil of sp.gr. 0.82 and has an entrance dia. of 125 mm while throat dia. 50 mm. There are pressure gauges at the entrance and at the throat, which is 50 mm above the entrance. If the Cd=0.97, find the flow when the pressure difference is 3 kPa. 7

9. (a) Analytically determine the coefficient of velocity coefficient of discharge and coefficient of contraction. 6

(b) A swimming pool 15 m long and 8 m wide holds water to a depth of 3.00 m at one end and 1.5 m at another end. If the water is discharged through a 20 cm dia. orifice at the deep end of side, find the time required to empty the pool (Cd=0.63). 8

OR

10. (a) Derive the expression for discharge over a rectangular notch with the consideration of velocity approach. 6

(b) A 10 m wide and 1 m deep irrigation channel is equipped with a sharp crested rectangular weir. The width of the weir is same as that of channel. If the head above the crest of the weir is 0.3 m. Find the discharge. Take Cd=0.62. Also find the discharge with the consideration of velocity of approach, when the velocity of approach is given as 0.3 m/sec. 8

11. The pressure rise Δp in the impeller of a centrifugal pump deponds on the impleller diameter D, rotational speed N, the dischargė Q, density ϱ, and viscosity μ. using Buckingham's π theorem, obtain an expression for pressure rise. 14

OR

12. Explain any **four** :—

(i) Reynold's apparatus.

(ii) Laminar and Turbulent–flows.

(iii) Geometric and kinematic Similarity.

(iv) Raleigh's method of dimentional analysis.

(v) Reynold's number. $3\frac{1}{2} \times 4 = 14$