[01 – 2210]

II/IV B.E. DEGREE EXAMINATION.

Second Semester

Civil Engineering

FLUID MECHANICS — I

(Common for Civil and Civil Environmental Engineering)

(Common with MS Civil Engineering)

(Effective from the admitted batch of 2006–2007)

Time : Three hours   Maximum : 70 marks

Question No. 1 is compulsory and its answers must be answered at one place.

Answer any other FOUR questions.

All questions carry equal marks.

1.   (a) Differentiate between U-tube manometer and inverse U-tube manometer.

(b) Why is turbulent type of flow more frequently encountered in practice than laminar flow?

6. (a) Derive Bernoullis equation from Eulers equations.

   (b) A 60° horizontal pipe bend of diameter 30 cm is gradually reduced to 15 cm diameter. The velocity of air at the entrance to the 30 cm section is 10 m/s and the pressure is 120 kN/m². Find the magnitude and the direction of force experienced by the bend. Density of air is 1.2 kg/m².

7. (a) Show that for laminar flow through circular pipe, the mean velocity is equal to half of the maximum velocity.

   (b) Two reservoir have difference of water level of 6 m. They are connected by a pipe system which consists of single pipe of 0.6 m diameter for the first 3 km and then two pipes in parallel each of 0.3 m diameter for length of 0.3 km. If $f = 0.04$, find the discharge.

8. Write short notes on :

   (a) Hardy - cross method of analysis

   (b) Orifice meter

   (c) Micro-manometer.

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(c) What is difference between vorticity and circulation?

(d) State the practical application of impulse-momentum equation.

(e) What are the typical features of Cippoletti weir?

(f) What is necessity for ventilation of weirs?

(g) List minor losses in pipes. Mention their empirical formulae.

2. (a) Show that in a fluid which is at rest the pressure is constant-along a horizontal plane and varies linearly with depth.

(b) A ship has a displacement of 5.5×10^7 N. Sea water (sp. gr = 1.025). The moment of inertia of its plan area at water line is 9000 m^4. When a load of 300 kN is shifted in a transverse direction on the deck by 5 m, the ship lifts over by an angle of 4°. Compute the meta centric height of the ship and the height of the ship and height of its CG above the centre of buoyancy.

3. (a) A circular plate of 4 m diameter is immersed in water with the top edge touching the water surface and its lower edge at a depth of 3 m below free surface. Determine the forces acting on the plane surface and centre of pressure.

(b) A tank 3 m in length, 2 m wide and 2 m deep containing 1.5 m depth of water is given a constant horizontal acceleration of 4 m/s². Determine the water surface slope. How much water will spill out from the tank?

4. (a) Differentiate between :
   (i) Steady and uniform flow
   (ii) Rotational and irrotation flow
   (iii) Laminar and turbulent flow and
   (iv) Free and forced vortex flow.

(b) A pipe line carrying water change in diameter from 20 cm at a section A to 50 cm diameter at Section B which is 4 m above A. If the pressures at A and B are 100 kN/m² and 80 kN/m² respectively and the discharge is 200 litres/s, determine the loss of head and the direction of flow.

5. (a) Kerosene of sp. gr. 0.8 flows through a 30 cm diameter by 15 cm diameter vertical venturi meter. The height of the converging cone is 50 cm. A mercury differential manometer connected between the inlet and throat shows a deflection of 68 cm in mercury levels. Assuming of $C_d = 0.985$, Calculate the rate of flow, if the inlet pressure is 1.6 bars what is the throat pressure?

(b) Derive the momentum equation for a steady in compressible fluid flow.

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