GUJARAT TECHNOLOGICAL UNIVERSITY
B. E. - SEMESTER – III • EXAMINATION – WINTER 2012

Subject code: 130602   **Date: 05-01-2013**
Subject Name: Fluid Mechanics
Time: 10.30 am – 01.00 pm   **Total Marks: 70**
Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Derive Darcy-Weisbach equation for friction loss in the pipe.   **07**
    (b) A horizontal venturimeter with inlet and throat diameter 30 cm and 15 cm respectively is used to measure the flow of water. The reading of differential manometer connected to the inlet and the throat is 20 cm of mercury. Determine the rate of flow. Take Cd = 0.98.   **07**

Q.2 **(a)** Explain stability of submerged and floating bodies with neat sketches.   **07**
    (b) Define surface tension .Explain capillarity with sketch.   **07**
    OR
    (b) Prove that the discharge through a triangular notch or weir is given by   **07**
    $$Q = \frac{8}{15} \ C_d \times \tan\frac{\theta}{2} \times \sqrt{2g}H^{\frac{3}{2}}$$

Q.3 **(a)** Define atmospheric pressure. Explain how atmospheric pressure is measured by various devices.   **07**
    (b) A circular plate 3.0 m diameter having a concentric circular hole of diameter 1.5 m is immersed in water in such a way that its greatest and least depth below the free surface are 4 m and 1.5 m respectively. Determine the total pressure and position of the centre of pressure on one face of the plate.   **07**
    OR
Q.3 **(a)** Explain Source, Sink and Doublet with sketch.   **07**
    (b) A wooden pole 25 mm X 25 mm X 4 mm attached to a steel weight at the bottom floats in sea water so that 0.6 m length of the pole is exposed. Calculate the steel weight attached. Specific gravities of sea water, wood and steel may be taken as 1.025, 0.60 and 7.85 respectively.   **07**

Q.4 **(a)** Define Stream line, Steady flow, Uniform flow, Turbulent flow, Rotational flow.   **07**
    (b) A pipe 100 mm in diameter and 40 meter long conveys water at a velocity of 2.50 meters per second. If the central 20 meters length of pipe is replaced by a 200 mm diameter pipe, find the saving in head loss. Assume that the changes in section are sudden. Take f = 0.01 and coefficient of contraction Cc = 0.62   **07**
    OR
Q.4 **(a)** What are the hydraulic co-efficient? Name them and derive the equation   Cc = Cd / Cv   **07**
    (b) If for a two dimensional potential flow, the velocity potential is given by   Ø = x (2y-1) determine the velocity at the point P (4, 5). Determine also the value of stream function Ψ at the point P.   **07**

Q.5 **(a)** Differentiate between notch and weir. Classify the weir on basis of shapes of   **07**

crest and describe all in brief.

(b) A vessel has two identical orifices provided in one of its sides at depth H_1 and H_2 below the free surface of water in the tank. Determine the position of the point of intersection of the two jets. If $H_1 = 2$ m and $H_2 = 5$ m and $Cv = 0.98$ for each orifice, locate the point of intersection of the two jets. **07**

OR

Q.5 **(a)** State the Bernoulli's theorem for compressible flow and derive Bernoulli's equation for Adiabatic process. **07**

(b) A projectile travels in air of pressure 10.1043 N/cm^2 at 10^{0}C at a speed of 1500 km/hour. Find the Mach number and the Mach angle. Take $k = 1.4$ and $R = 287$ J/kg^{0}K. **07**

****