Civil Sem III - Fluid Mechanics-I (CBSG)

Q. P. Code: 21636

01 JUN 2018

(3 hours)

Max. Marks: 80

Note:

Question no.1 is compulsory

Solve any 3 questions out of remaining

Assume data wherever necessary and clearly mention the assumptions made.

Draw neat figures as required.

1. Answer any 4 of the following. 20
   a. Explain Doublet and define the strength of doublet.
   b. Explain Hydraulic coefficients.
   c. State & Prove Pascal's Law
   d. Define the terms: Velocity potential function; and Stream function.
   e. Explain Rotameter and Pitot tube.

2. a. State Bernoulli's theorem for steady flow of an incompressible fluid. Derive an expression for Bernoulli's theorem from first principle and state the assumptions made for such a derivation. 10

   b. Two large horizontal plane surface are 20 mm apart. This space is filed with glycerin. Find what force is required to drag a very thin plate of area 0.60 m^2 between the two surfaces at a speed of 0.70 m/sec (i) if the plate is equidistance from the two surfaces; (ii) if the plate is 7.50 mm from one of the surfaces. Take the dynamic viscosity of glycerin equal to 8.04×10^{-1} Ns/m^2. 10

3. a. A circular plate 3 m diameter and having a concentrate 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 center of pressure on one face of the plate. 10

   b. A closed vessel contains water upto a height of 2.0m and over the water surface there is air having pressure 8.829 N/cm^2 above atmospheric pressure. At the bottom of vessel there is an orifice of diameter 15cm. find the rate of flow of water from orifice. Take C_d equals to 0.6. 10

4. a. If for a two dimensional potential flow, the velocity potential is given by: $\Phi = 4x\,(3y - 4)$, determine the velocity at the point (2,3). Determine also the value of stream function Ψ at the point (2,3). 10

b. A 20 x 10 cm venturimeter is provided in the vertical pipe line carrying oil of specific gravity 0.8, the flow being upwards. The difference in the elevation of throat section and entrance section of venturimeter is 50cm. The differential U tube mercury manometer shows a gauge deflection of 40 cm. Calculate: (i) the discharge of oil; and (ii) the pressure difference between the entrance section and the throat section. Take $C_d = 0.98$ and specific gravity of mercury as 13.6. 10

5. a. Show that a cylinder buoy of 1.5 m diameter and 3 m long weighing 25 kN will not float vertically in sea water of density 1030 kg/m^3. 10

b. A rectangular channel 2.0 m wide has a discharge of 250 lps, which is measured by a right angled V notch weir. Find the position of the apex of the notch from the bed of the channel if maximum depth of water is not to exceed 1.3m. Take C_d= 0.62. 05

c. Explain flow past a Rankine oval body. 05

6. a. Water is flowing in a rectangular channel of 1.2 m wide and 0.8 m deep. Find the discharge over rectangular weir of crest length 70 cm if the head of water over the crest of weir is 25 cm and water from channel flows over the weir. Take Cd=0.60. Neglect end contractions but consider velocity of approach. 10

b. An open circular cylinder of 20 cm diameter and100 cm long contains water upto a height of 80 cm. it is rotated about its vertical axis. Find the speed of rotation when (I)no water spills; and (ii) axial depth is zero. 10