

(3 hours)

Note:

Max. Marks: 80

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 flow.
 - b. Explain Cipolletti weir or notch along with formula and neat sketch.
 - c. Write Eulers equation of motion and derive Bernoulli's equation from it. Mention all assumptions made.
 - d. Write a note on working of Bourdon Pressure Gauge with a neat sketch.
 - e. Define: Density; Weight density; specific Volume; Specific Gravity and; viscosity.

2. a. An oil film of thickness 1.5 mm is used for lubrication between a square plate of size 0.9 m x 0.9 m and an inclined plane having an angle of inclination 20° . The weight of the square plate is 392.4 N and it slides down the plane with a uniform velocity of 0.2 m/s. Find the dynamic viscosity of oil. 08

 b. Find the discharge of water flowing through a pipe 30 cm diameter placed in an inclined position where a venturimeter is inserted, having a throat diameter of 15 cm. The difference of the pressure between the main and throat is measured by a liquid of sp. gr. 0.6 in an inverted U-tube which gives a reading of 30 cm. The loss of head between the main and throat is 0.2 times the kinetic head of the pipe. 12

3. a. An external cylindrical mouthpiece of diameter 100 mm is discharging water under a constant head of 8 m. Determine the discharge and absolute pressure head of water at vena-contracta. Take $C_d = 0.855$ and C_c for vena-contracta = 0.62. Take atmospheric pressure head = 10.3 m of water. 10

 b. A circular plate of 3 m diameter is under water with its plane making an angle of 30° with the water surface. If the top edge of the plate is 1 m below the water surface, find the force on one side of the plate and its location. 10

Turn Over

4. a. An open circular cylinder of 20 cm diameter and 100 cm long contains water upto a height of 80 cm. It is rotated about its vertical axis. Find the speed of rotation when: no water spills and; axial depth is zero. 10
- b. A weir 36 m long is divided into 12 equal bays by vertical posts, each 0.6 m wide. Determine the discharge over a weir if the head over the crest is 1.20 m and velocity of approach is 1.2 m/s. Use Francis formula. 10
5. a. A rectangular pontoon 8.0 m long, 7 m broad and 3 m deep weighs 588.6 kN. It carries on its upper deck an empty boiler of 4 m diameter weighing 392.4 kN. The center of gravity of the boiler and pontoon are at their respective centers along a vertical line. Find the metacentric height. Weight density of sea water is 10104 N/m^3 . 12
- b. Describe experimental determination of Hydraulic Coefficients. 08
6. a. State & Derive Pascal's Law 06
- b. An oil of sp. gr. 0.8 under a pressure of 137.2 kN/m^2 . What is the pressure head expressed in meters of water? What is the pressure head expressed in meters of oil? 04
- c. If for a two dimensional potential flow, the velocity potential is given by $\phi = x(2y - 1)$; determine the velocity at the point (4, 5). Determine also the value of stream function at that point? 10
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