

Seat No.	
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S.E. (Civil) (Semester - III) (Revised)

Examination, November - 2019

FLUID MECHANICS - I

Sub. Code : 63341

Day and Date : Saturday, 30 - 11 - 2019

Total Marks : 100

Time : 10.00 a.m. to 1.00 p.m.

- Instructions :**
- 1) Attempt any three questions from each section.
 - 2) Assume necessary data if not given

SECTION - I

Q1) a) Define and give practical examples of following properties. Also give their S I Units. **[8]**

- i) Viscosity,
- ii) Vapour pressure,
- iii) Surface tension and capillarity,
- iv) Bulk modulus of elasticity

b) What do you mean by similitude? Explain. **[8]**

A spillway model is to be built to a scale of 1:50 across a model flume of 600 mm width. The prototype is 15 m high and maximum head is 1.5 m.

What head and height of model should be used?

If model discharge is 12 LPS, what will be discharge on prototype spillway?

If negative pressure on the model is 200 mm, what will be the pressure on prototype?

Q2) a) How would you determine the vertical and horizontal components of the resultant pressure on a submerged curved surface? **[5]**

b) Find the total pressure acting on a dam with vertical upstream face if the total depth of water stored is 50m out of which the bottom 10m is silt of specific gravity 1.2. Find also the position of total pressure. Consider the unit length of dam. Draw pressure diagram. **[8]**

c) Explain the procedure of determination of metacentric height experimentally. **[5]**

P.T.O.

- Q3) a)** Define velocity potential and stream function. What is the relation between them? The stream function for a two dimensional flow is given by $\psi = 2xy$, calculate the velocity at point P(2, 3). Find the velocity potential function. [8]
- b) Derive the continuity equation in differential form for three dimensional flow. [8]
- Q4)** Write short notes on any four. [16]
- Dimensionless numbers: Froude's Number and Reynolds's number.
 - Pressure measurement devices.
 - Equilibrium conditions for floating and submerged object.
 - Flow net: construction and uses.
 - Distorted and undistorted models.

SECTION - II

- Q5) a)** Draw neat sketch of following devices and explain their working. [8]
- Venturimeter,
 - Orificemeter,
 - Pitot tube,
 - Orifice
- b) Derive the expression for emptying the tank through circular orifice. A circular tank of diameter 1.25m contains water upto height of 5m. An orifice of diameter 50 mm is provided at its bottom. If C_d is 0.62, find the height of water above the orifice after 90 seconds. [8]
- Q6) a)** Derive Hazen-Poiseuille equation for laminar flow and further prove that friction factor $f = 64/Rn$. [8]
- b) What are factors affecting Boundary layer thickness?
- The velocity distribution in a boundary layer is given by $u/V = (3/2)\eta - (1/2)\eta^3$, where $\eta = (y/\delta)$ compute (δ^*/δ) and (θ/δ) where δ^* is displacement thickness and θ is momentum thickness. [8]

- Q7) a) What is syphon? Derive an expression for negative pressure at the summit. Draw a sketch. What are the uses of syphon? [8]
- b) The difference in water surface levels in two tanks is 12 m, which are connected by three pipes in series of length 300m, 170m and 210 m and of diameters 30cm, 20cm, 40cm respectively. Determine the rate of flow through this compound pipe if coefficient of friction are 0.02, 0.0208, 0.0192 respectively. Consider minor losses. [8]

Q8) Write short notes on any three. [18]

- a) Calibration of orifice in laboratory.
- b) Moody's chart.
- b) Hydrodynamically smooth and rough pipe.
- d) Water hammer
- e) Surge tank

