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# RN-6143

## B. E. - II (Sem. III) Examination

### May / June – 2010

## Fluid Mechanics - I

Time : **3** Hours] [Total Marks : **100**

**Instructions :**

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
**Fillup strictly the details of ☛ signs on your answer book.**

Name of the Examination :

☛ **B. E. - 2 (Sem. 3)**

Name of the Subject :

☛ **Fluid Mechanics - 1**

☛ Subject Code No. : **6 1 4 3** ☛ Section No. (1, 2,.....) : **1&2**

Seat No. :

Student's Signature

(2) Figures on the right indicate full marks.

(3) Assume suitable data where necessary.

(4) Use of programmable calculator is not allowed.

## SECTION - I

**1** (a) Differentiate between : **6**

(i) Real fluid and Ideal fluid

(ii) Centre of pressure and Centre of bouyancy

(iii) Uniform and Non uniform flow.

(b) Explain the phenomenon of surface tension and derive the relation between surface tension and pressure inside a droplet of liquid in excess of outside pressure. **7**

(c) A glass of 3 mm diameter is immersed vertically in water of surface tension $\sigma$ = 0.08 N/m. Calculate the capillary rise. **5**

What would be the capillary fall when the same glass is immersed in mercury of surface tension, $\sigma$ = 0.5 N/m and angle of contact = 130°.

2 Attempt any **two** : **8×2=16**

(i) A solid cylinder of diameter 6.0 m is floating in water with its axis vertical. Find the meta-centric height and check the stability. Assume sp. gravity of material as 0.6 and hight of cylinder 6.0 m.

(ii) Derive the centre of pressure of a vertical plane surface submerged in liquid.

(iii) Derive continuity equation in three dimensions.

(iv) The velocity components in a two dimensional flow field for an incompressible fluid is given as $v = xy^2 - 2y - \frac{x^3}{3}$,

$u = \frac{y^3}{3} + 2x - x^2 y$.

Obtain an expression for the stream function $\psi$.

3 Write short notes on : (any **three**) **15**

(i) Phenomenon of cavitation

(ii) U-tube manometer

(iii) Conditions of equilibrium of submerged bodies

(iv) Types of fluid flow.

## SECTION - II

4 (a) Derive the Euler's equation of motion. Write down the assumptions made in the derivation of Bernoulli's equation. Write Bernoulli's equation for real fluid. **10**

(b) A pipe of diameter 400 mm carries water at a velocity 25 m/s. The pressure at the points A and B are given as 29.43 N/cm$^2$ and 22.563 N/cm$^2$ respectively while the datum head at A and B are 28 m and 30 m. Find the loss of head between A and B. **10**

5 (a) Find the expression for rate of flow through venturimeter. Show with a neat sketch of venturimeter. **10**

(b) A horizontal venturimeter with inlet and throat diameters 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 $c_d$ = 0.98. **10**

**OR**

5 (a) Derive the expression for rate of flow through orifice meter or orifice plate. **10**

(b) An orifice meter with orifice diameter 10 cm is inserted in a pipe of 20 cm dia. The pressure gauges fitted upstream and downstream of the orifice meter give readings of 19.62 N/cm$^2$ and 9.81 N/cm$^2$ respectively. Coefficient of discharge for the meter is given 0.6. Find the discharge of water through pipe. **10**

6 Write short notes on the following : (any **three**) **12**

(i) Reynold's experiment for demonstrating laminar and turbulent flow

(ii) Classification of notches and weirs

(iii) Capillary tube viscometer

(iv) Classification of orifices and mouthpieces

(v) Pitot tube.

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