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RN-8055

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

May / June – 2010

Fluid Mechanics

(As per GTU Syllabus)

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) (Civil)**

Name of the Subject :

☛ **Fluid Mechanics**

☛ Subject Code No. : **8 0 5 5** ☛ Section No. (1, 2,.....) : **1&2**

Seat No. :

Student's Signature

(2) All the questions are **compulsory**.

(3) Figures to the right indicate full marks.

(4) Assume necessary data where necessary.

SECTION - I

1 (a) Define the following :

(i) Steady flow

(ii) Absolute pressure

(iii) Laminar flow

(iv) Sink

(v) Newtonian fluid

(vi) Capillarity.

(b) Define surface tension and prove that the pressure inside a droplet (in excess of the outside pressure intensity) increases with decrease of diameter of the droplet. **4**

(c) (i) Discuss different types of fluids with figure. **5**

(ii) Derive the unit of dynamic viscosity and determine the fluid viscosity between two plates such that one plate is 0.03 mm distant from a fixed plate and moves at 60 cm/sec. It requires a force of $3N/m^2$ to maintain this speed. **5**

2 (a) Show that centre of pressure of a vertical plane surface submerged in liquid lies below the centre of gravity of the vertical surface. **8**

OR

(a) Define meta-centric height. Derive an expression for the meta-centric height of a floating body. **8**

(b) A fluid flow is given by **6**

$$V = x^2 y\,i + y^2 z\,j - \left(2xyz + yz^2\right)k$$

Prove that it is a case of possible steady incompressible fluid flow. Calculate the velocity at the point (2,1,3)

3 (a) Attempt any **two** : **10**

(i) An open circular cylinder of 14 cm diameter and 100 cm long contains water upto a height of 75 cm. Find the maximum speed at which the cylinder is to be rotated about its vertical axis so that no water spills.

(ii) Prove that in case of forced vortex, the rise of liquid level at the ends is equal to the fall of liquid level at the axis of rotation.

(iii) A uniform flow with a velocity of 3 m/s is flowing over a source placed at the origin.

The stagnation point occurs at (–0.45, 0). Determine

(a) Strength of the source

(b) Maximum width of Rankine half body

(b) Differentiate the following : (any **three**) **6**

(i) Simple manometer and differential manometer.

(ii) Stream line and streak line

(iii) Linear translation and linear deformation

(iv) Forced vortex flow and free vortex flow.

(v) Steady and unsteady flow.

SECTION - II

4 (a) Derive the expression for discharge over a triangular notch or weir. **10**

(b) Find the discharge through a trapezoidal notch which is 1 m wide at the top and 0.40 m at the bottom and is 30 cm in height. The head of water on the notch is 20 cm. Assume C_d for rectangular portion as 0.62 while for triangular portion as 0.60. 8

5 (a) Derive the expression for discharge through orifice meter in terms of coefficient of contraction C_c. 8

(b) An oil of sp. grade 0.8 is flowing through a venturimeter having inlet diameter 20 cm and throat diameter 8 cm. The oil mercury differential manometer, shows a reading of 20 cm. Calculate the discharge of oil through the horizontal venturimeter
Take C_d = 0.98. 8

OR

5 (a) Derive the expression for head loss for flow through three pipes in series when 8

(i) Minor losses are neglected

(ii) minor losses are taken into consideration

Show with a neat sketch.

(b) A main pipe is divided into two parallel pipes which again forms a pipe. The length and diameter for the first parallel pipe are 2000 m and 1.0 m respectively while the length and diameter of second parallel pipe are 2000 m and 0.8 m. Find the rate of flow, in each parallel pipe if total flow in the main pipe is 3.0 m^3/s. The coefficient of friction for each parallel pipe is same and equal to 0.005.

6 Write short notes on the following : (any **four**) **16**

(i) Hydraulic gradient line (HGL) and Total gradient line (TGL)

(ii) Classification of orifice and mouthpiece

(iii) Pitot tube

(iv) Mach number and on the basis of Mach no. various types of flow

(v) Flow through branched pipes.
