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RM-6443

B. E. II (Sem. IV) (Civil) Examination

May / June – 2010

Fluid Mechanics - II

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. II (Sem. 4) (Civil)**

Name of the Subject :

☛ **Fluid Mechanics - 2**

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

Seat No. :

Student's Signature

(2) Figure to the right indicate full marks.
(3) Assume missing data suitably with appropriate remarks.
(4) Draw sketches whereever necessary.

SECTION - I

1 (a) Explain the scale effect in models and how it leads to departure from complete similarity. **7**

(b) A solid sphere of diameter 100 mm moves in water at 5 m/sec. It experiences a drag of 19.62 N. What would be the velocity of 5 m diameter sphere moving in air to ensure similarity. What will be the drag force experienced. State the law that governs the similarity. Viscosity of air = 13 × viscosity of water. Mass density of air = 1.2 kg/m^3 **8**

OR

(b) Starting from Prandtl mixing length theory obtain the expression: **8**

$V = \frac{V_*}{K} \log_e y + C$, for point velocity for turbulant flow in pipes, the terms have their usual meaning, V* is shear velocity.

2 (a) Develop an expression for shear stress in turbulent flow as given by Bossinesq. Explain how it is of limited use. **7**

(b) Explain how dimensional; analysis and similarity lead to understanding of fluid flow problems and establishment of mathematical relationships. Explain how a .....model analysis will be done when both viscous and gravity forces are of importance. **8**

OR

(b) Explain the mechanism of momentum transfer due to transverse movement of fluid parties and show how it leads to a shearing stress. Explain wall turbulance, free turbulance in pipes. **8**

3 Write short notes on any **three** of the following : **15**

(i) Momentum thickness.

(ii) Existence of dimensionally homogeneous and non homogeneous equations

(iii) Geometric and dynamic similarity of models.

(iv) Principle and procedure for determination of flow in pipe network by Hardy cross law.

(v) Explain concepts of turbine reversible turbine and generator.

SECTION - II

4 (a) Derive Chezy's formula of loss of head due to friction in pipes. **6**

(b) Derive the expression for the force exerted by a jet when it strikes the curved plate at one end tangentially when the plate is symmetrical. **6**

(c) Show that the loss of head due to sudden expansion in a pipe line is a function of velocity head. **6**

5 (a) A pelton wheel has a mean bucket speed of 10 meter per second with a jet of water flowing at the rate of 700 lit / s under a head of 30 mts. The bucket deflects the jet through an anlge of 160^{o}. Calculate the power given by water to the runner and the hydraulic efficiency of the turbine. Assume coefficient of velocity as 0.98. **10**

(b) A nozzle of 50 mm diameter delivers a stream of water at 20 m/s perpendicular to a plate that moves away from the jet at 5 m/s. T-incl **10**

(i) the force on the plate

(ii) the work done, and

(iv) the efficiency of the jet.

OR

5 (a) An oil of specific gravity 0.9 and viscosity 0.06 poise is flowing through a pipe of diameter 200 mm at the rate of 60 lit /s.Find the head lost due to friction for a 500 m length of pipe. Find the power required to maintain this flow. **10**

(b) Find the loss of head when a pipe of diameter 200 mm is suddenly enlarged to a diameter of 400 mm. The rate of flow of water through the pipe is 250 litress. **4**

(c) Define and explain hydraulic efficiency, mechanical efficiency and overall efficiency of a trubine. **6**

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

(i) Main parts of a Radial flow reaction turbine.

(ii) Classification of hydraulic turbines.

(iii) Loss of energy in pipes.

(iv) Hydraulic gradient line and Total energy line.
