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Printed Pages—4 TCE—301

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 4070 Roll No. | | | | | | | | | | |

B.Tech.

THIRD SEMESTER EXAMINATION, 2005-2006

FLUID MECHANICS

Time : 3 Hours *Total Marks : 100*

Note : *(i) Attempt **ALL** questions.*

(ii) All questions carry equal marks.

(iii) In case of numerical problems assume data wherever not provided.

(iv) Be precise in your answer.

1. Attempt ***any two*** parts of the following : **(10x2=20)**

(a) (i) Discuss effect of temperature and pressure on the physical properties of the fluid.

(ii) Derive an expression for capillary rise or fall when a small dia tube dipped in to a liquid.

(b) (i) Prove that the centre of pressure is always below the centre of gravity for vertical or inclined plane surfaces.

(ii) A wooden cylinder of sp. gravity = 0.60 and circular in cross-section is required to float in oil of sp. gravity = 0.80. Find the H/D ratio for the cylinder to float with its longitudinal axis vertical in oil, where H is the height of cylinder and D is its diameter ?

(c) Describe Buckingham's -π-theorem. Why this theorem is considered superior over Rayleigh's method for dimensional analysis ?

2. Attempt *any two* parts of the following : **(10x2=20)**

(a) Discuss geometric, kinematic and dynamic similarities. Are these similarities truely attainable ? If not why ?

(b) (i) Deduce an expression of continuity equation for three dimensional flow.

(ii) Distinguish between forced vortex and free vortex flow.

(c) (i) What is a Pitot tube ? How is it used to measure velocity of flow at any point in a pipe or open channel ?

(ii) Distinguish between the following with neat sketches.

Notches and weirs.

Orifices and mouthpieces.

3. Attempt *any four* parts of the following : **(5x4=20)**

(a) State the momentum equation. How it is used in0 determining the force exerted by a flowing liquid on a pipe bend ?

(b) Explain the method for the determination of coefficient of velocity, coefficient of contraction and coefficient of discharge experimently.

(c) Prove that for laminar flow through a circular pipe, momentum correction factor $(\beta) = \frac{4}{3}$.

(d) A fluid of viscosity $0.72 \frac{N.S}{m^2}$ and Sp. gravity 1.34 is flowing through a circular pipe of diameter 100 mm. The maximum shear stress at the pipe wall is given as $200 N/m^2$, find (i) the pressure gradient (ii) the average velocity and (iii) Reynold number of the flow.

(e) What do you understand by Prandtl's mixing length theory ? Find an expression for shear stress due to Prandtl.

(f) What do you understand by turbulent flow ? What factor decides the type of flow in pipe ?

4. Attempt *any four* parts of the following : **(5x4=20)**

(a) Show that the energy thickness for boundary layer flow is given by $\delta_E = \int_0^{\delta} \frac{u}{U}\left(1 - \frac{u^2}{U^2}\right) dy$

(b) What are the causes of loss of energy in a pipe.

(c) What do you mean by the separation of boundary layer ? What is the effect of pressure gradient on boundary layer thickness ?

(d) Discuss and derive an expression for equivalent pipe.

(e) Define and discuss Hydraulic gradient and total energy lines with neat sketches.

(f) The 30 cm diameter pipe 2340 m long is connected with a reservoir whose surface is 72 m above the discharging end of the pipe. If for the last 1170 m a second pipe of the same diameter be laid beside the first and connected to it, What would be the increase in the discharge ? Take f = 0.02.

5. Attempt *any two* parts of the following : **(10x2=20)**

(a) Explain the phenomenon of water hammer. Obtain an expression for the rise of pressure when the flowing water in a pipe is brought to rest by closing the valve gradually.

(b) Define and distinguish with neat sketches between source flow and sink flow.

(c) Differentiate between the following :

(i) Stream lines body and bluff body.

(ii) Friction drag and press drag.

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