53 (CE 605) HDEN

2017

HYDRAULIC ENGINEERING

Paper : CE 605

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

Answer ***All*** *questions.*

1. Water is flowing with a velocity '*v*' *m/s* in a pipe of length 'L'*m* and diameter '*D*' *mm*. At the end of the pipe a value is provided. If the thickness of pipe is '*T*' *mm* and value is suddenly closed at the end of pipe, then find the rise in pressure (*P*) *if* pipe is considered to be elastic. Assume modulus of rigidity is 0·25. 10

2. Determine the thickness of boundary layer at the trailing edge of smooth plate of length $4m$ and width $1{\cdot}5m$ when the plate is moving with velocity of $4m/s$ in stationary air.

Also determine the total drag on one side of the plate assuming that *(i)* boundary layer is laminar over entire the plate and *(ii)* the boundary layer is turbulent from the very beginning. Take Kinematic viscosity of air is $1{\cdot}5\times10^{-5}\,m^2/s$ and density of air is $1{\cdot}226\,kg/m^3$. 10

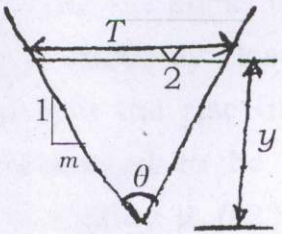
3. Distinguish between deformation drag, surface drag and form drag. In case of sphere, discuss their relative importance at various increasing values of Reynolds number. 10

4. Water is flowing through a rough pipe of diameter $8cm$. velocity at a point $3{\cdot}0cm$ from wall is 30% more than velocity at a point $1cm$ from pipe wall. Determine the average height of roughness. 10

5. Derive (on the basis of Buckingham II theorem) the suitable parameters to present the thrust developed by a propeller. Assume that the thrust (P) depends upon angular velocity 'ω', velocity of advances 'v', diameter 'D', dynamic viscosity 'μ', mass density 'ρ' and elasticity of fluid medium which can be denoted by speed of sound in the medium 'C'. 10

6. The pressure drop in an aeroplane model of size 1/40 of its prototype is $80\,N/cm^2$. The model is tested in water. Find the corresponding pressure drop in the prototype. Take density of air is $1{\cdot}24\,kg/m^3$. The viscosity of water is 0·01 *poise* while viscosity of air is 0·00018 *poise*. 10

7. Find the critical depth and specific energy at critical depth for a triangular channel. 10



8. Describe the following terms (draw figure if required) [***any six*** of the following] 5×6=30

(a) Classification of flow profiles (slopes) with examples.

(b) Surge tank.

(c) Boundary layer separation of fluid.

(d) Terminal fall velocity.

(e) Hydraulically smooth and rough flow.

(f) Similarity laws.

(g) Classification of hydraulic turbines

(h) Hydraulic efficiency, Mechanical efficiency and overall efficiency.