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

2. Write down the properties of turbulent flow. What do you mean by Nikuradse's equivalent roughness ?
   Write in details about hydraulically smooth and rough flow. 4+2+4=10

3. Derive the mathematical expression for velocity distribution for turbulent flow in smooth pipe. 10

4. Determine the wall shearing stress in a pipe of diameter 100*mm* which carries water. The velocities at the pipe centre and 30*mm* from the pipe centre are 2*m/s* and 1·5*m/s* respectively. The flow in pipe is given as turbulent. 10

5. If y_1 and y_2 are alternate path in a rectangular channel then show that and specific energy *(E)* 10

$$y_c^3 = \frac{2y_1^2 y_2^2}{y_1 + y_2}$$

$$E = \frac{y_1^2 + y_1 y_2 + y_2^2}{y_1 + y_2}$$

6. A flat plate 1·5*m*×1·5*m* moves at 50*km* per hour in stationary air of density 1·15kg/m^3. If coefficient of drag and lift are 0·15 and 0·75 respectively. The determine *(i)* lift force *(ii)* drag force *(iii)* resultant force *(iv)* power required to keep the plate in motion. 10

7. Derive (on the basis of Buckingham Π theorem) the suitable parameter to present the thrust developed by a propeller. Assume that the thrust (P) depends upon angular velocity w, 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

8. Answer the following : 6×5=30

(a) Write a short note on Terminal fall velocity of fluid with mathematical expression.

(b) Write down a short note on Magnus effect.

(c) Find the critical depth and specific energy for a rectangular channel when flow of depth is Y and channel width B.

(d) Draw the flow profiles for steep and adverse slope with an example of each.

(e) What do you mean by geometric and kinematic similarity ? Give an example of each similarity.

(f) Write down a short note on boundary layer separation of fluid flow.
