53 (CE 605) HDEN

2018

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. Describe the following terms : (Draw the figure, if required) 5×6=30

   (a) Classification of flow profiles with examples

   (b) Surge tanks

   (c) Boundary layer separation

   (d) Terminal fall velocity

   (e) Similarity laws

   (f) Classification of hydraulic turbines.

2. (a) Write down the definition of nominal boundary layer thickness, displacement thickness, momentum thickness.

   (b) Derive the mathematical expression for energy thickness in boundary layer region. 6+9=15

3. The air having a velocity of $40m/s$ is flowing over cylinder of diameter $1{\cdot}5m$ and length $10m$, when the axis of cylinder is perpendicular to the air stream. The cylinder is rotated about its axis and lift of $6867N$ per meter length of cylinder is developed. Find the speed of rotation and location of stagnation points. The density of air is given as $1{\cdot}25kg/m^3$. 10

4. Derive on the basis of dimension analysis suitable parameters to present developed by a propeller. Assume that the thrust P depends upon the angular velocity ω, velocity of advance v, diameter D, dynamic viscosity μ, mass density ρ, elasticity of fluid medium which can be denoted by speed in the medium C. 15

5. The ratio of lengths of a submarine and its model is 30 : 1. The speed of submarine is $10m/s$. The model is tested in wind tunnel. Find the speed of air in wind tunnel. Also, determine the ratio of drag between model and prototype. Take the value of kinematic viscosity for sea water and air as 0·012 stokes and 0·016 stokes respectively. The density for sea water and air is given as $1030kg/m^3$ and $1{\cdot}24kg/m^3$ respectively. 10

6. What do you mean by gradually varied flow? Derive the governing differential equation for GVF in a rectangular channel. 10

7. What do you mean by Magnus effect ? Write in details about Karman vortex trails in turbulent flow. 10
