ce 6 sem applied hydraulics-ii dec 2015 (3 hours)

Note: Max. Marks 80

Question no.1 is compulsory

Solve any 3 questions out of remaining

Assume data wherever necessary and clearly mention the assumptions made.

Draw neat figures as required.

1. Answer any 4 of the following.
   (a.) Explain control measures for Boundary Layer separation
   (b.) Explain Magnus Effect
   (c.) Write a note on Specific Energy Curve
   (d.) Write a note on Surface profiles of Open channel
   (e.) Explain Laceys Silt theory.

2. (a.) A thin plate is moving in the direction parallel to its length in still air at a velocity of 4.0 m/s. The length of the plate is 0.5 m and width is 0.6 m. Taking $\nu_{air} = 1.5 \times 10^{-5} m^2/s$ and $\rho_{air} = 1.25\ kg/m^3$, calculate (a) the boundary layer thickness at the end of the plate,(b) shear stress at 20cm from the leading edge and (c) drag force on one side of the plate. 10

   (b.) Derive expression for lift force acting on rotating cylinder (Kutta Joukowski Equation). 10

3. (a.) Determine momentum thickness and energy thickness for given velocity distribution profile in the boundary layer: 10

$$\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$$

   (b.) A 3.6m wide rectangular channel carries water at a depth of 1.8 m. In order to measure the discharge the channel width is reduced to 2.4m and a hump of 0.3m is provided in the bottom. Calculate the discharge if the water surface in the contracted section drops by 0.15m. Assume no losses. 10

[TURN OVER]

4. (a) A trapezoidal channel having one side vertical and other side at a slope of 2H to 1 V discharges 14.25 m^3/s of water at a velocity of 1 m/s. The channel lining has Mannings coefficient N = 0.0125. Find the dimensions of the channel for least expenditure of energy. Find also the bed slope. 10

(b.) A cylinder rotates at 300 rpm about its axis which is perpendicular to the air stream having a velocity of 2 m/s. The cylinder is 2 m in diameter and 10 m long. Find (a) the circulation, (b) the theoretical lift force per unit length.(c) the position of stagnation points (d) the actual lift and drag and the resultant force on the cylinder. Take density of air 1.24 kg/m^3. For determining actual drag and lift, take (v_p/U)=1.57, C_d = 0.65, and C_l = 3.40 10

5. (a.) A rectangular channel has a width of 1.8m and carries a discharge of 1.8 m^3/s at a depth of 0.20m. Calculate (a) the specific energy, (b) depth alternate to the existing depth and (c)Froude number at the alternate depth. 08

(b.) Determine the length of the back water curve caused by an affux of 1.5m in a rectangular channel of width 50m and depth 2.0m. The slope of the bed is given as 1 in 2000. Take Mannings N = 0.03. 12

6. (a.) Derive an expression for depth of Hydraulic Jump. 10

(b.) Design an irrigation channel by Kennedys theory to carry a discharge of 50 cumecs at a slope of 1:5000. Take Kutters N = 0.0225 and m = 0.9.