

End Semester Examinations - 2015-16 Even Semester - May 2016

14CE2005 Applied Hydraulics and Hydraulic Machinery

Set B

Time : 3 hrs
Total Marks: 100

1. A trapezoidal channel has side slopes of 1 horizontal to 2 vertical and the slope of the bed is 1 in 2000. The area of the section is 42m^2 . Calculate the dimensions of the section if it is most economical. Determine the discharge of the most economical section if $C=60$

OR

2. Find the ratios of displacement thickness to momentum thickness and momentum thickness to energy thickness for the velocity distribution in the boundary layer given by $u/U = 2(y/\delta) - (y/\delta)^2$ where u = Velocity in boundary layer at distance y , U = Free- stream velocity, δ = Boundary layer thickness.
3. A thin plate is moving in still atmospheric air at a velocity of 5 m/s. The length of the plate is 0.60 m and width 0.50 m. Determine the thickness of the boundary layer at the end of the plate and drag force on one side of the plate. Assume density of air as 1.24 kg/m^3 and kinematic viscosity 0.15 stokes.

OR

4. A jet of water of diameter 50 mm moving with a velocity of 25 m/s impinges on a fixed curved plate tangentially at one end at 30° to the horizontal. Determine the resultant force exerted by the jet on the plate if the jet is deflected through 50° .
5. A flat plate $1.5\text{ m} \times 1.5\text{ m}$, moves at 50 km/hr in stationary air with density 1.15 kg/m^3 . If C_D and C_L are 0.15 and 0.75 respectively, determine lift force, resultant force, power required to keep the plate in motion.

OR

6. An inward reaction turbine has external and internal diameter as 0.9m and 0.45m respectively. The turbine is running at 200rpm and width of the turbine at inlet is 200mm. The guide blade makes an angle of 10° and the discharge at the outlet is radial. The velocity of flow at inlet and outlet is constant and equal to 1.8m/s. Draw the inlet and outlet velocity triangles and determine.
- Runner Blade angles
 - Mass of water flowing per second
 - Power developed at the turbine
 - Hydraulic efficiency
7. The water available for a Pelton wheel is $4\text{m}^3/\text{s}$ and the total head from the reservoir to the nozzle is 250m. The turbine has two runners with two jets per runner. All the four jets have the same diameters. The pipe is 3 m long. The efficiency of transmission through the pipeline and the nozzle is 91% and efficiency of each runner is 90%. The velocity co-efficient of each nozzle is 0.975 and co-efficient of friction '4f' for the pipe is 0.045. Determine
- power developed by the turbine
 - diameter of the jet and
 - diameter of the pipeline.

OR

8. A Pelton wheel is to be designed for the following specifications: Shaft power = 11,772 kW; Head = 380 meters; Speed = 750 rpm; Overall efficiency = 86%; Jet diameter is not to exceed one sixth of the wheel diameter. Take $C_v = 0.985$ and $K_u = 0.45$. Determine:
- wheel diameter
 - number of jets required

c. diameter of the jet.

9.

b) A Centrifugal pump is to discharge $0.118 \text{ m}^3/\text{s}$ at a speed of 1250rpm against a head of 55m. The impeller diameter is 200mm, its width at outlet is 60mm and manometric efficiency is 70%. Determine the vane angle at outer periphery of impeller. (15)

a) Explain the components of centrifgal pump with neat sketch (5)

Wishing you All the Best
