B.E. Civil Engineering Sixth Semester

CE603 - Fluid Mechanics-II

P. Pages : 3 **GUG/W/18/1669**

Time : Three Hours * 1 3 1 3 * Max. Marks : 80

Notes : 1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) Assuming the low for the velocity distribution in a laminar boundary layer on a flat plate as $u = a + by + cy^2$ where y is measured at right angle to the plate and a, b and c are constant show that the velocity profile is given by **8**

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

where - δ - Thickness of boundary layer.
U - Approach velocity.

b) A flat plate 1.5m x 1.5m moves at 50 km/hr in a stationary air of density 1.15 kg/m^3. The coefficient of drag and lift are 0.15 and 0.75 respectively determine. **8**

i) The lift force ii) The drag force
iii) The Resultant force iv) The power required to keep the plate in motion

OR

2. a) A 1.8 m wide and 5 meter long plate moves through a stationary air of density 1.22 kg/m^3 and viscosity 1.8 x 10^{-5} Ns/m^2 at a velocity 1.75 m/s. Parallel to its length. Determine the drag force on one side of plate. **8**

i) Assuming laminar flow condition ii) Assuming Turbulent flow condition.

b) Write a note on **8**

i) Magnus effect ii) Airfoil

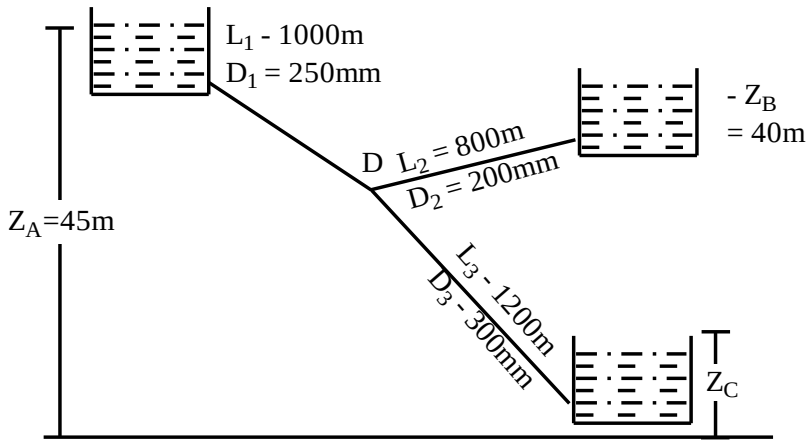
3. a) Difference of water level in two water reservoir is 8 m. They are connected by 40m long pipe. For the first 25 m length diameter is 120 mm and for remaining length 200 mm. Change in diameter being sudden find discharge into the lower reservoir f = 0.008. **8**

b) From a reservoir two Parallel pipe of diameter 150 mm and 200 mm each 100 m long convey a total discharge of 0.12m^3/sec. Find the head lost due to friction. **8**
If however the two pipes are arrange in series to convey the same discharge what would be the head lost due to friction take f = 0.0075.

OR

4. a) Water flowing in a long pipe is suddenly stopped by closing a valve at discharge end. The diameter of pipe is 180 mm and its thickness is 8 mm the quality of water flowing in pipe is 25 meter per sec. Find the rise of pressure due to instantaneous clouser of valve at discharge end $E = 2\times10^5\ N/mm^2$ $K = 2\times10^5\ N/mm^2$. Find also corresponding hoop stress develop in wall of pipe. **8**

b) Three reservoirs are connected by a pipe system. If the discharge from the reservoir A is $0 \cdot 05 m^3/s$ determine rate of flow into or from reservoir B and C. Find also RL of water level in reservoir C $f = 0.008$. **8**



5. a) Water flow at a rate of $16 m^3/s$ in a channel 10m wide at a velocity of 1.6m/s calculate the specific energy head. Find also the critical depth, critical velocity and minimum value of specific energy head corresponding to discharge in the channel. **8**

b) A concrete lined trapezoidal channel has to discharge 500 cum/sec. The side slope are 1H:1V and the bed slope is 1 in 4000 the permissible velocity is 2.50m/s. Determine bottom width and depth of the section take N = 0.014. **8**

OR

6. a) A very wide rectangular channel convey a discharge of $3.25 m^3/sec$ per meter width at a depth of 2.50m. The bed slope is 1:5000 due to weir placed across the channel the water level is raised by 1.50m just on upstream of it. Find at what distance upstream of the weir the depth of water will be 3m. Take C=52 use direct step method and take two step also classify the type of water surface profile. **8**

b) The loss of energy head in a hydraulic jump is 4.25m. The Froude number just before the jump is 7.50m. Find **8**

i) Discharge per meter width of channel.
ii) Depth before and after hydraulic jump.
iii) Froude number after the jump.
iv) Percentage loss of energy head due to jump.
v) Length of jump.

7. a) A 100mm diameter jet discharges $0.45 m^3/s$ impinges on a series of vanes moving at 20m/s. The direction of jet and direction of motion of the vane are same at inlet, each vane is so shaped that, if stationary it would deflect the jet by 165º Calculate: **8**

i) Force exerted in direction of motion of vane.

ii) Power develop.

iii) Hydraulic efficiency.

b) A 1/20 scale model was tested in order to determine resistance of prototype ship, model has wetted area of $2.75\,m^2$. The prototype velocity is 3.50m/s in sea water of density $1040\,kg/m^3$. When model was moved at corresponding speed. The total resistance was found to be 31.40N. The skin resistance of model in fresh water is $0.0927 \times V^{1.9}\ N/m^2$ and that of the ship in sea water is $0.0885\ V^{1.85}\ N/m^2$. **8**

Calculate:

i) Corresponding speed of the model.

ii) Total resistance of the ship.

OR

8. a) Calculate the number of jet required for Pelton wheel to develop a shaft power of 1830kW under 480m head at a speed of 600rpm. The coefficient of velocity of jet is 0.98. Speed ratio is 0.46 overall efficiency is 85% take jet ratio 1/9. **8**

b) Turbine is to operate under a head 25m at 200rpm the discharge is $9\,m^3/sec$. If efficiency is 90% determine **8**

i) Specific speed ii) Power generated

iii) Type of turbine iv) Performance and a head of 20m.

9. a) The inlet and outlet diameter of the impeller of a centrifugal pump are 150mm and 450mm respectively and corresponding impeller width are 40mm an 18mm vane angle at inlet and outlet are 20º and 15º respectively The pump runs at 1800rpm. neglect losses. determine. **8**

i) Discharge ii) Direction of flow leaving the impeller

iii) Head developed by the impeller iv) Power of pump

v) Pressure rise through the impeller

b) Define specific speed of centrifugal pump and derive equation of specific speed. **8**

OR

10. a) Write a note on: **8**

i) Pump with air vessel ii) Multi cylinder pump

b) A single acting reciprocating pump has a plunger diameter 150mm and stoke length 300mm. The pump run at 35rpm and lift water through a height of 20m. Calculate the theoretical discharge and theoretical power required if actual discharge is 2.885 liter/sec. Find the percentage slip. **8**

If the delivery pipe is 15m long and has a diameter 100m. Find the acceleration pressure head at the beginning of the delivery stroke.

If a large air vessel is fitted close to a cylinder on the delivery side. Find the pressure head necessary in the cylinder to overcome friction in delivery pipe Take f = 0.0075.

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