

Seat  
No.

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मजल - 038

## Fluid Mechanics - II (1020)

P. Pages : 3

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answersheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **any two** bits from each question.
5. Figures to the right indicate full marks.
6. Assume suitable data if required.
7. Use of non programmable calculator is allowed.

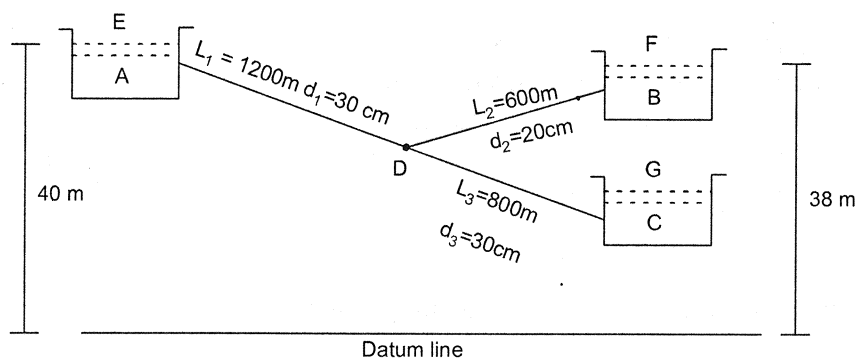
1. a) i) Define various thicknesses of boundary layer. 5  
ii) Discuss drag on cylinder. 5  
b) i) For the velocity profile for turbulent boundary layer  $\frac{u}{U} = (y/\delta)^{1/7}$   
Obtain an expression for boundary layer thickness. 8  
ii) Sketch the effect of pressure gradient on boundary layer separation. 2  
c) i) Calculate the weight of a ball of diameter 8 cm which is just supported in a vertical air stream which is flowing at a velocity of 7 m/sec. The density of air is  $1.25 \text{ kg/m}^3$ . The kinematic viscosity of air is 1.5 stokes. 8  
ii) Define stream line and bluff body. 2
2. a) A horizontal pipe line 40 m long is connected to a water tank at one end discharges freely into the atmosphere at the other end for the first 25 m of its length from the tank the pipe is 15 cm diameter and its diameter is suddenly enlarged to 30 cm. The height of water in tank is 8m above the centre of pipe considering all losses of head which occur determine the rate of flow. Take  $f = 0.01$  for both sections of pipe. 10

- b) A syphon of diameter 20 cm connects two reservoirs having a difference of elevation 15 m the total length of syphon is 600 m and the summit is 4m above the water level in the upper reservoir. If the separation takes place at 2.8 m of water absolute find the maximum length of syphon from upper reservoir to the summit. Take  $f = 0.004$  and atmospheric pressure = 10.3 m of water.

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- c) Three reservoirs A, B, C are connected by a pipe system as shown in fig. Find the discharge into or from the reservoirs B and C if the rate of flow from reservoir A is 60 lit/sec find the height of water in reservoir C. Take  $f = 0.006$  for all pipes.

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3. a) i) Classify bed slopes in an open channel.

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- ii) How will you designate surface profile.

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- b) With usual notation prove the relation

$$\frac{y_2}{y_1} = \frac{1}{2} \left[ -1 + \sqrt{8F_{r1}^2 + 1} \right]$$

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- c) A rectangular channel 15 m wide carries a discharge with the normal depth of 3m. The bed slope of the channel is 1/3600. It at a certain section the depth of flow is to be raised to 4m. Determine how far upstream of this section the depth of flow would be within 10% of the normal depth. Use step by step method and take only two steps. Assume  $n = 0.015$  classify and sketch the profile.

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4. a) A jet of water having a velocity of 40 m/sec strikes a curved vane which is moving with a velocity of 20 m/sec. The jet makes an angle of  $30^\circ$  with the direction of motion of vane at inlet and leaves at an angle  $90^\circ$  to the direction of motion of vane at outlet. Draw velocity triangles at inlet and outlet and determine the vane angles at inlet and outlet so that water enters and leaves the vane without shocks.

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- b) A Pelton wheel is to be designed for the following specifications.  
 Shaft power = 11.772 kw, Head = 380 m, Speed = 750 r.p.m.  
 Overall efficiency = 86% Jet diameter is not to exceed one sixth of the  
 wheel diameter. Determine :
- Wheel diameter
  - Number of jet required.
  - Diameter of Jet.

Take  $k_{v1} = 0.985$ ,  $k_{u1} = 0.45$ .

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- c) Define specific speed of turbine and derive expression for specific speed.

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5. a) A centrifugal pump with 1.2 m diameter runs at 200 r.p.m. and pumps  
 1880 lit/sec the average lift being 6m. The angle which the vanes makes  
 at exit with the tangent to the impeller is  $26^\circ$  and radial velocity of flow is  
 2.5 m/sec. Determine the manometric efficiency and least speed to start  
 pumping against a head of 6m, the inner diameter of impeller being 0.6 m.

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- b) A single stage centrifugal pump with impeller diameter of 30 cm rotates at  
 2000 r.p.m. and lifts  $3\text{m}^3$  of water per second to a height of 30 m with the  
 efficiency of 75%. Find the number of stages and diameter of each  
 impeller of similar multistage pump to lift  $5\text{m}^3$  of water per second to a  
 height of 200 meters when rotating at 1500 r.p.m.

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- c) Write short note on :

i) Priming of centrifugal pump.

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ii) Multistage centrifugal pump.

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