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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. Answer sheet 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 questions.
5. Figures to the right indicate full marks.
6. Assume suitable data it required.
7. Use of non programmable calculator is allowed.

1. a) i) Discuss drag on sphere. **5**

ii) Write detail note on boundary layer separation. **5**

b) For the following velocity profiles. determine weather the flow has separated or on the verge of separation or will attach with the surface. **10**

i) $\frac{u}{V} = \frac{3}{2}\left(\frac{y}{\delta}\right) - \frac{1}{2}\left(\frac{y}{\delta}\right)^2$

ii) $\frac{u}{V} = Z\left(\frac{y}{\delta}\right)^2 - \left(\frac{y}{\delta}\right)^3$

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

c) An airfoil of chord length 2 m and span 15 m has an angle of attack 6º. The airfoil is moving with a velocity 80 m/sec in the air whose density is 1.25 kg/m^3. Find the weight of airfoil and power required to drive it. The values of coefficient of drag and lift corresponding to angle of attack are 0.03 and 0.5 respectively. **10**

2. a) State various minor losses in pipe and derive. Darcy Weisbatch equation for major loss. **10**

b) Write short note on

i) Sugar tank. **5**

ii) Reynold expression for turbulent shear stress. **5**

c) At a sudden enlargement of water main from 240 mm to 480 mm diameter. the hydraulic gradient rises by 10 mm. Estimate the rate of flow. **10**

3. a) A sluice gate discharges water into a horizontal rectangular channel with velocity 5 m /sec and depth of flow 0.35 m width of channel is 7 m. Determine weather the hydraulic jump will occur and if so determine its height and loss of energy per N of water. Determine also power lost in jump. **10**

b) Define G. V. F. open channel. State the basic assumptions used in G. V. F. theory. Also derive the dynamic equation for G. V. F. **10**

c) A rectangular channel 20 m wide flow with the normal depth of 2 m and bed scope of 1/6400. At a certain section the depth of flow is 3 m. How for upstream or down stream of the section will the depth be 2.6 m. use step method and take two steps. Sketch and classify the profile. Take n = 0.015. **10**

4. a) A jet of water having velocity 20 m /sec strikes a curved vane which is moving with a velocity of 10 m /sec. The jet makes an angle of 20º with the direction of motivation of vane at inlet and leaves at an angle of 130º to the direction of motion of vane at outlet. calculate. **10**

i) Vane angles so that the water enters and leaves the vane without shock.

ii) Work done per second per unit weight of water striking the vane per second.

b) A pelton wheel is to be designed for a head of 60 m when running at 200 r.p.m. The pelton wheel develops 95.6475 KW shaft power. The velocity of buckets is 0.45 times the velocity of get. Overall efficiency is 0.85 and coefficient of velocity is 0.98. Determine necessary data for design. **10**

c) i) Give a general layout of a hydro - electric power plant. **5**

ii) Write a note on Cavitation in turbines. **5**

5. a) i) State and explain various efficiencies of centrifugal pump. **5**

ii) Explain model analysis of centrifugal pump. **5**

b) The diameter of centrifugal pump which is discharging 0.03 m^3/sec of water against a head of 20 m is 0.4 m. The pump is running at 1500 r.p.m. Find the head, discharge and and ratio of power of a geometrically similar pump. of diameter 0.25 m when it is running at 3000 r.p.m. What will be the specific speed for the second pump. **10**

c) A centrifugal pump with external diameter 600 mm. and internal diameter 200mm delivers 500 lps of water against a head of 15 m. The speed of pump is 600 r.p.m. The vanes of impeller are carved backwards at an angle of 30º to the wheel tangent at outlet. The velocity of flow is constant at 2 m /sec if the entry to the pump is radial determine. **10**

i) Power required.

ii) Efficiency

iii) Minimum starting speed.

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