Week #6. PRINCIPLE OF TURBOMACHINES

Assignment 6

The due date for submitting this assignment has passed. **Due on 2018-09-19, 23:59 IST.**
As per our records you have not submitted this assignment.

Instructions:
1. For questions (1-6): fill in the blanks
2. For questions (7-10): select the most appropriate option
3. Take density of water as 1000 kg/m3 and acceleration due to gravity as 9.81 m/s^2.

Note: The numerical value marked in red colour is correct answer while the answers within the numerical range of value given in the blue colour are considered as correct answer.

1) **Keeping this data answer Question 1 and 2**

Flow rate developed by a pump is 0.02 m^3/s. Blade specific work of a pump based c congruent flow is 350 m^2/s^2. Slip, i.e. the ratio of actual exit absolute tangential velocit ideal value (C'_{2u}/C_{2u}) is 0.75. Hydraulic efficiency is 80%, leakage is 5% and mec efficiency is 95%. Neglect disc friction and return flow losses.

Head developed by the pump is..... (m).

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 19,23

5 points

2) Power required by the pump is..... (kW).

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 5,7

5 points

3) **Keeping this data answer Question 3 and 4**

The basic design of a centrifugal pump has a shape number of 0.075 rev. The blades are f facing on the impeller and the outer angle is 120° to the tangent, with an impeller passage at outlet equal to one-tenth of the diameter. The pump is to be used to pump water a v distance of 35 m, at a flow rate of 0.04 m^3/s. The suction and delivery pipes are each of 1 diameters and have a combined length of 40 m with a friction factor of 0.05. Other losses

the speed of impeller …….. (rpm).

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 1945,1965

6 points

4) the diameter of pump impeller …….. (m).

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 0.2,0.25

6 points

5) **Keeping this data answer Question 5 and 6**

A centrifugal pump with the following dimensions is used to raise water through a static h H_{Static} with a flow rate of Q m^3/s while running at a speed of 1450 rpm.

$d_1 = 135$ mm; $d_2 = 270$ mm; $b_2 = 15$ mm; $\beta_{2b} = 30°$; $\beta_{1b} = 10°$

The flow velocities (meridional) at inlet and exit of the impeller are equal. Neglect thickness effect. Slip factor i.e. the ratio of actual exit absolute tangential velocity to its value (C'_{2u}/C_{2u}) is 0.75. Hydraulic efficiency is 0.82, and leakage is 5%. The suction delivery pipe diameters are equal to 125 mm. The head losses in the suction and delivery are 3 and 5 times the dynamic head in the pipes respectively. Find,

the optimum flow rate …….. (m^3/s).

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 0.012,0.025

6 points

6) the corresponding static head …….. (m).

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 17,27

6 points

7) **Keeping this data answer Question 7 and 8** *6 points*

A radial-flow water turbine has an inlet diameter of 2 m and an outlet diameter of 1.2 m breadth of the blades is constant and is equal to 0.2 m. The runner rotates at a speed of 25(with a discharge of 8 m^3/s. The vanes are radial at inlet and discharges radially outwar outlet. Consider hydraulic efficiency as 90% and mechanical efficiency to be 92%.

Blade angle (in degree) at outlet is

- 12
- 34
- 56
- 68

No, the answer is incorrect.
Score: 0

Accepted Answers:
34

8) Power developed by the turbine (in kW) is *6 points*

- 1000
- 2018
- 5035
- 7063

No, the answer is incorrect.
Score: 0

Accepted Answers:
5035

9) *2 points*

Discharge ($\dot{V}$) of a centrifugal pump is given by (where D = Diameter of impeller at inlet, b = Wi of impeller at inlet, and Cm= Velocity of flow at inlet)

- $\dot{V} = \pi.D.\ Cm$
- $\dot{V} = \pi.b.\ Cm$
- $\dot{V} = \pi.D.b.\ Cm$
- $\dot{V} = D.b.\ Cm$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\dot{V} = \pi.D.b.\ Cm$

10) *2 points*

In case of turbines, if the volume flow rate is $\dot{V}$, effective volume flow rate handled by t turbine impeller (considering leakage flow $\Delta\dot{V}$) is:

- $\dot{V}_{eff} = \dot{V}$
- $\dot{V}_{eff} = \dot{V} + \Delta\dot{V}$
- $\dot{V}_{eff} = \dot{V} - \Delta\dot{V}$
- $\dot{V}_{eff} = \sqrt{\dot{V} \times \Delta\dot{V}}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\dot{V}_{eff} = \dot{V} - \Delta\dot{V}$

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