Week 3: Assignment 3

The due date for submitting this assignment has passed.

Due on 2021-08-25, 23:59 IST.

As per our records you have not submitted this assignment.

1) From the model test results, the performance of the prototype can be extrapolated when, ***1 point***

- The geometrical Similarity is valid.
- The geometrical and kinematic similarity are valid.
- The geometrical and dynamic Similarity are valid.
- None of the above.

No, the answer is incorrect.
Score: 0

Accepted Answers:
The geometrical and dynamic Similarity are valid.

2) If Ψ is the head coefficient, ϕ flow coefficient, $\hat{P}$ hydraulic power coefficient, and η overall efficiency, then which of the following statement is valid? ***1 point***

- For a compressor or turbine, $\hat{P} = \frac{\phi \times \psi}{\eta}$
- For a compressor or turbine, $\hat{P} = \phi\psi\eta$
- For a compressor, $\hat{P} = \phi\psi\eta$ and turbine, $\hat{P} = \frac{\phi \times \psi}{\eta}$
- For a compressor, $\hat{P} = \frac{\phi \times \psi}{\eta}$ and turbine, $\hat{P} = \phi\psi\eta$

No, the answer is incorrect.
Score: 0

Accepted Answers:
For a compressor, $\hat{P} = \frac{\phi \times \psi}{\eta}$ and turbine, $\hat{P} = \phi\psi\eta$

3) For turbomachines with geometric and dynamic similarity (ψ, ϕ are the head and flow coefficient), which of the following statement is most appropriate, ***1 point***

- $\psi = f[\phi, \mu]$
- $\psi = f[\phi]$
- $\psi = f[\phi, Re]$
- $\psi = f[\phi, Re, \frac{l}{D}]$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\psi = f[\phi]$

4) The dimensionless specific speed (Ω, *Q, H, P* represent speed, flow rate, head, and power) of a turbomachine handling incompressible flow can be expressed as ***1 point***

- $\frac{\Omega Q^{1/2}}{H^{3/4}}$
- $\frac{\Omega P^{1/2}}{H^{5/4}}$
- $\frac{\Omega Q^{1/2}}{(gH)^{3/4}}$
- None of the above.

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{\Omega Q^{1/2}}{(gH)^{3/4}}$

5) When the $\psi - \phi$ characteristic curves of the model and that of the prototype are superimposed, they represent, ***1 point***

- A unique characteristic curve
- Separate characteristic curves
- Might be or might not be a unique characteristic curve.
- None of the above.

No, the answer is incorrect.
Score: 0

Accepted Answers:
A unique characteristic curve

6) The dimensionless specific diameter (Ω, *Q, H, P* represent speed, flow rate, head, and power) of a turbomachine handling incompressible flow can be expressed as ***1 point***

- $d_s = \frac{DH^{5/4}}{Q^{1/2}}$
- $d_s = \frac{D(gH)^{5/4}}{Q^{1/2}}$
- $d_s = \frac{D(gH)^{1/4}}{Q^{1/2}}$
- None of the above.

No, the answer is incorrect.
Score: 0

Accepted Answers:
$d_s = \frac{D(gH)^{1/4}}{Q^{1/2}}$

7) For a multistage axial turbine, no further increase in $\dot{m}\frac{\sqrt{T_{01}}}{p_{01}}$ is possible after a certain pressure ratio and the flow is said to be chocked. The is because of, ***1 point***

- Hight pressure ratio
- Hight temperature ratio
- Large loss
- Mach number becomes less that unity.
- Mach number at a section becomes unity.

No, the answer is incorrect.
Score: 0

Accepted Answers:
Mach number at a section becomes unity.

8) For a given design of turbine operating with a given fluid at sufficiently high Reynolds number (where, 01 and 02 refer to the stagnation states at the turbine inlet and exit, respectively), it can be shown from the dimensional analysis as, ***1 point***

- $\frac{P_{01}}{P_{02}} = f\left(\frac{\dot{m}\sqrt{\gamma RT_{01}}}{P_{01}D}, \frac{\Omega D}{\sqrt{\gamma RT_{01}}}\right)$
- $\frac{P_{01}}{P_{02}} = f\left(\frac{\dot{m}\sqrt{T_{01}}}{D^2}, \frac{\Omega D}{\sqrt{T_{01}}}\right)$
- $\frac{P_{01}}{P_{02}} = f\left(\frac{\sqrt{T_{01}}}{P_{01}}, \frac{\Omega}{\sqrt{T_{01}}}\right)$
- $\frac{P_{01}}{P_{02}} = f\left(\frac{\dot{m}\sqrt{T_{01}}}{P_{01}}, \frac{\Omega}{\sqrt{T_{01}}}\right)$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{P_{01}}{P_{02}} = f\left(\frac{\dot{m}\sqrt{T_{01}}}{P_{01}}, \frac{\Omega}{\sqrt{T_{01}}}\right)$

9) A fan operating at 1550 rev/min and at a volume flow rate of 4.5 m^3/s, develops a head of 135 m. It is required to build a larger, but the geometrically similar fan, which will deliver the same head and efficiency of the existing fan at a speed of 1400 rev/min. Calculate the volume flow rate of the larger fan.

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 5.0,6.0

2 points

10) Following Q9, what is the non-dimensional specific speed of these fans? [Hint: $n_s = \frac{\Omega\sqrt{Q}}{(gH)^{3/4}}$]

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 1.2,1.8

2 points

11) An axial flow compressor is designed to run at 4500 rpm while the mass flow rate being 65 kg/s, when atmospheric conditions are 101.3 kPa and 15°C. On the day when the performance characteristics is obtained, the observed atmospheric temperature is 25°C and the pressure at the entry of the compressor is 60 kPa. What is the corrected speed at which the compressor must run?

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 4570,4585

1 point

12) Following Q11, evaluate the mass flow rate obtained in the test.

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 37.2,38.4

2 points