Week 8 : Assignment 8

The due date for submitting this assignment has passed.

Due on 2021-09-22, 23:59 IST.

As per our records you have not submitted this assignment.

1) In a centrifugal compressor, choking means, *1 point*

- increase in mass flow rate with a decrease in pressure ratio
- decrease in mass flow rate with a reduction in pressure ratio
- mass flow rate does not change witha decrease in pressure ratio
- none of these

No, the answer is incorrect.
Score: 0
Accepted Answers:
mass flow rate does not change witha decrease in pressure ratio

2) For an axial flow compressor, the constant speed characteristic curves terminate at a line beyond which the operation becomes unstable, known to be *1 point*

- choking line
- surge line
- operating line
- none of these

No, the answer is incorrect.
Score: 0
Accepted Answers:
surge line

3) Why is the relative Mach number at the inlet of the centrifugal compressor kept between 0.7-0.8? *1 point*

- To avoid the shock in the impeller passage.
- For maximum efficiency operation.
- To decrease the specific work input.
- None of these

No, the answer is incorrect.
Score: 0
Accepted Answers:
To avoid the shock in the impeller passage.

4) In a turbojet engine, a typical value of the surge margin is kept as, *1 point*

- 10%
- 20%
- 30%
- 40%

No, the answer is incorrect.
Score: 0
Accepted Answers:
20%

5) The slip velocity in a centrifugal compressor can be related to *1 point*

- Coriolis force.
- Centrifugal farce.
- Lift and drag.
- Relative eddy.

No, the answer is incorrect.
Score: 0
Accepted Answers:
Relative eddy.

6) The expression for Stodola slip factor for a radial flow machine can be expressed as, *1 point*

- $\lambda = \frac{w_2 - C_{f2}\cot\beta_1 - u_2}{u_2 - C_{f2}\cot\beta_2}$
- $\lambda = 1 - \frac{\pi}{N}$
- $\lambda = 1 - \frac{C_{f2}\cos\beta_2}{N}$
- None of these

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\lambda = 1 - \frac{\pi}{N}$

7) A multistage axial compressor is used to compress air. The stage total temperature rise is ΔT_0, while the blade speed U. The inlet and exit relative flow angles with respect to axial direction are β_1 and β_2 respectively, where ϕ is the flow coefficient. The stage loading factor $\psi = C_p \Delta T_0 / U^2$ is defined as, *1 point*

- $\phi(\tan\beta_1 - \tan\beta_2)$
- $\phi(\tan\beta_2 - \tan\beta_1)$
- $\phi(\tan\beta_1 + \tan\beta_2)/2$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\phi(\tan\beta_1 - \tan\beta_2)$

8) In a multistage axial compressor, the overall temperature ratio and polytropic efficiency are 1.5 and 90%, respectively. Assuming γ = 1.4, the overall pressure ratio will be, *2 points*

- 3.0-3.3
- 3.3-3.5
- 3.5-3.7
- 3.7-4.0

No, the answer is incorrect.
Score: 0
Accepted Answers:
3.5-3.7

9) A multistage axial compressor is used to compress air at 293 K. The overall pressure ratio of the compressor is 5.0. Follow data are given for the compressor. *3 points*

The degree of reaction: 50%
The mean blade speed: 275 m/s
The flow coefficient, ϕ : 0.5
The stage loading, ψ : 0.3
The stage efficiency, 88.8%

Assume $\gamma = 1.4$, $R = 287 J/kgK$,, and the stage efficiency is taken constants for all stages.
Evaluate, the flow angles β_1 and β_2.

- $\beta_1 = 35.3°; \beta_2 = 55.6°$
- $\beta_1 = 55.6°; \beta_2 = 35.3°$
- $\beta_1 = 52.43°; \beta_2 = 35.0°$
- $\beta_1 = 35.0°; \beta_2 = 52.50°$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\beta_1 = 52.43°; \beta_2 = 35.0°$

10) A multistage axial compressor is used to compress air at 293 K. The overall pressure ratio of the compressor is 5.0.The stage efficiency is 88.8%, which is considered the same for all stages. Assume $\gamma = 1.4$, $R = 287 J/kgK$. *2 points*
Calculate the overall isentropic efficiency.

- 85.8-86.2 %
- 84.5-85.8%
- 86.2-87.3%
- 87.3-90.0%

No, the answer is incorrect.
Score: 0
Accepted Answers:
85.8-86.2 %

11) The following data refer to a single-sided centrifugal compressor: *4 points*

Overall diameter of impeller:	0.5m
Eye tip diameter:	0.3m
Eye root diameter:	0.15m
Rotational speed:	290 rev/s
The inlet air velocity:	145 m/s
Ambient condition:	1.1 bar & 295 K

Assume $\gamma = 1.4$, $R = 287 J/kgK$. Assume, no pre-whirl, no loss in the intake duct. Calculate, the relative Mach number at the tip (M_t) of the eye.

- M_t=0.86-0.88
- M_t= 0.88-90
- M_t=0.90-93
- M_t=0.93-95

No, the answer is incorrect.
Score: 0
Accepted Answers:
M_t=0.90-93

12) The following data refer to a single-sided centrifugal compressor: *2 points*

Overall diameter of impeller:	0.5m
Eye tip diameter:	0.3m
Eye root diameter:	0.15m
Rotational speed:	290 rev/s
The inlet air velocity:	145 m/s
Ambient condition:	1.1 bar & 295 K

Assume $\gamma = 1.4$, $R = 287 J/kgK$. Assume, no pre-whirl, no loss in the intake duct. Evaluate the mass flow rate through the centrifugal compressor in kg/s.

- 9.3-9.7 kg/s
- 8.9-9.3 kg/s,
- 8.6-8.9 kg/s,
- 8.3-8.6 kg/s,

No, the answer is incorrect.
Score: 0
Accepted Answers:
8.9-9.3 kg/s,