

Unit 5 - Week 3: Quasi-One Dimensional Isentropic Flow

Course outline

How does an NPTEL online course work?

Week 0: Prerequisite

Week 1: Review Concepts of Fluid Mechanics and Thermodynamics

Week 2: Wave Propagation in Compressible Medium

Week 3: Quasi-One Dimensional Isentropic Flow

Lec 7: Quasi-One Dimensional Isentropic Flow - I

Lec 8: Quasi-One Dimensional Isentropic Flow - II

Lec 9: Quasi-One Dimensional Isentropic Flow - III

Quiz : Assignment 3

Feedback form

Lecture notes_Week 3

Sample solution- Assignment 3

Week 4: Normal Shock Waves

Week 5: Expansion Waves and Oblique Shocks

Week 6: Interaction of Shocks and Expansion Waves

Week 7: Compressible Flow with Friction and Heat Transfer

Week 8: Measurement Diagnostics and Experimental Facilities for Compressible Flow

Live Session

Text Transcripts

Practice Questions for Examination

Assignment 3

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-10-07, 23:59 IST.

1) An ideal gas is flowing through a constant area duct. The nature of the flow is defined as steady, isentropic and one-dimensional. Which parameter(s) remain constant for this flow? **2 points**

- (A) Velocity and pressure
 (B) Enthalpy
 (C) Temperature and density
 (D) Mach number

No, the answer is incorrect.
Score: 0

Accepted Answers:

- (A) Velocity and pressure
 (B) Enthalpy
 (C) Temperature and density
 (D) Mach number

2) In case of nozzle action, which event must happen in the flow direction? **2 points**

- (A) Velocity of the flow increases while pressure decreases.
 (B) Velocity of the flow decreases while pressure increases.
 (C) Both velocity and velocity increases.
 (D) Both velocity and pressure decreases.

No, the answer is incorrect.
Score: 0

Accepted Answers:

- (A) Velocity of the flow increases while pressure decreases.

3) For a compressible flow in a variable area duct, the "diffuser action" for flow parameter refers to decrease in velocity and increase in pressure. **2 points**

- (A) TRUE
 (B) FALSE

No, the answer is incorrect.
Score: 0

Accepted Answers:

- (A) TRUE

4) In a supersonic flow, the decrease in flow velocity is associated with _____ in area. **2 points**

- (A) DECREASE
 (B) INCREASE

No, the answer is incorrect.
Score: 0

Accepted Answers:

- (A) DECREASE

5) In a convergent-divergent duct with air ($\gamma = 1.4$) flow under choked flow condition, the percentage decrease in density at the throat of the duct, with respect to density of atmospheric air is _____.

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:

- (Type: Range) 35,38

2 points

6) What is the maximum speed (in m/s) that can be achieved by accelerating stagnant air ($R = 287$ J/kg-K) at standard sea level ($p = 101.325$ kPa; $T = 288$ K) condition?

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:

- (Type: Range) 759.5,761.5

2 points

Specialized reacting gases with molecular weight 16 are used as fuel in the combustion chamber of a rocket engine. The stagnation pressure of the gas inside the combustion chamber is 25 times the atmospheric pressure while the stagnation temperature is 3571 K. This gas is expanded through a convergent-divergent nozzle isentropically. The minimum area (throat) of the nozzle is 0.4 m² and the exit pressure is 0.01174 atm. Assume the combustible gases to be calorically perfect with specific heat ratio of 1.22. Use the value of Universal gas constant as 8314 J/kg-K. Based on these data, find out the following parameters for Q7-Q10.

7) The exit Mach number for the nozzle is _____.

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:

- (Type: Range) 5.1,5.3

2 points

8) The exit velocity (in m/s) of the combustible gas is _____.

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:

- (Type: Range) 3920,3935

2 points

9) The exit area (in m²) of the nozzle is _____.

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:

- (Type: Range) 45,52

2 points

10) The mass flow rate (in kg/s) of the gas through the nozzle is _____.

Hint

No, the answer is incorrect.
Score: 0

Accepted Answers:

- (Type: Range) 480,498

2 points