

## Unit 10 - Week 8: Measurement Diagnostics and Experimental Facilities for Compressible 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

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

Lec 22: Measurement Diagnostics and Experimental Facilities for Compressible Flow - I

Lec 23: Measurement Diagnostics and Experimental Facilities for Compressible Flow - II

Lec 24: Measurement Diagnostics and Experimental Facilities for Compressible Flow - III

Quiz : Assignment 8

Feedback form

Lecture Notes\_Week 8

Sample solution-Assignment 8

Live Session

Text Transcripts

Practice Questions for Examination

## Assignment 8

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

**Due on 2020-11-11, 23:59 IST.**

1) A non-dimensional number plays a key role for a stagnation temperature measurement by a probe mounted on the wall surface in a supersonic flow field. **2 points**  
Identify this non-dimensional number.

- (A) Peclet number  
 (B) Reynolds number  
 (C) Nusselt number  
 (D) Prandtl number

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
(D) Prandtl number

2) Which of the following (s) are optical flow visualization techniques? **2 points**

- (A) Interferometer  
 (B) Schlieren  
 (C) Shadowgraph  
 (D) PIV technique

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
(A) Interferometer  
(B) Schlieren  
(C) Shadowgraph  
(D) PIV technique

3) The R-type thermocouple is made out of \_\_\_\_\_ materials. **2 points**

- (A) chromel and alumel  
 (B) chromel and constantan  
 (C) platinum and platinum-rhodium  
 (D) Iron and constantan

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
(C) platinum and platinum-rhodium

4) Identify the type of thermocouple, which has the highest working temperature limit. **2 points**

- (A) E type  
 (B) J type  
 (C) K type  
 (D) S type

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
(D) S type

5) Which among the following sensors is not used for temperature measurement? **2 points**

- (A) RTD  
 (B) Thin film gauge  
 (C) Hot wire anemometer  
 (D) Optical Pyrometer

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
(C) Hot wire anemometer

6) A pressure transducer mounted at the end flange of a shock tube facing the flow will measure, \_\_\_\_\_ pressure. **2 points**

- (A) Static  
 (B) Stagnation  
 (C) Both of these  
 (D) Depends on flow condition

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
(B) Stagnation

7) In a high-speed flow environment, the interferometer measures the change in \_\_\_\_\_ of the flow field. **2 points**

- (A) pressure  
 (B) velocity  
 (C) density  
 (D) temperature

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
(C) density

8) In a shock tube experiment, nitrogen ( $\gamma = 1.4$ ,  $R = 297 \text{ J/kg-K}$ ) at 300 K is used as driver gas with test gas air in the driven section. There are two high frequency pressure transducers, mounted along the driven section that gives two near step response at a time interval of 0.817 ms. Find the shock Mach number of the flow if the distance between the pressure transducer is 0.5 m.

Hint

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
(Type: Range) 1.73, 1.74

**2 points**

9) The stagnation temperature of a supersonic flow is measured as 530 K, by a temperature probe having a recovery factor of 0.98. The flow Mach number is 1.4 for which, the isentropic values of static to total temperature is 0.7184. Calculate free stream static temperature (in °K).

Hint

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
(Type: Range) 375.5, 385.5

**2 points**

10) A Pitot tube is used to measure the velocity of an airstream ( $\gamma = 1.4$ ,  $R=287 \text{ J/kg-K}$ ) at 20°C and 101.325 kN/m<sup>2</sup>. The flow velocity is measured as, 2.5 m/s. Calculate the dynamic pressure (in N/m<sup>2</sup>).

Hint

No, the answer is incorrect.  
Score: 0

Accepted Answers:  
(Type: Range) 3.6, 3.9

**2 points**