

Unit 12 - Week 10: Liquid Propellant Rocket Engines: Injection system, Atomization, Combustion Process and Feed System

Course outline

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Week 3: Nozzle Characteristics

Week 4: Characteristic Parameters of Rocket Nozzle

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Week 6: Types of Propellant & its Selection, Multi-staging of rocket and SRPE

Week 7: Solid, Liquid & Composite Propellant Rocket Engine, Burning and Flame Structure

Week 8: Solid Propellants: Characteristics & Regression Rate Relation

Week 9: Evolution of Burning surface, Ignition System of Solid Propellant Grains, Types of Liquid Propellant Rocket Engine and Injection System

Week 10: Liquid Propellant Rocket Engines: Injection system, Atomization, Combustion Process and Feed System

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Week 10: Assignment

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

Due on 2019-10-09, 23:59 IST.

1) In rapid combustion zone of liquid propellant combustion process, radial velocity becomes smaller as compared to axial one. 1 point

Given statement is:

- True
 False

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

2) Co-axial injector is a type of impinging injector. Given statement is: 1 point

- True
 False

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

3) The mixing of fuel and oxidizer is better for honeycomb shape injectors distribution as compared to the concentric shape of the same. Given statement is: 1 point

- True
 False

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

4) Specific volume variation of gaseous product during combustion is identical for both hypergolic and non-hypergolic propellant. Given statement is: 1 point

- True
 False

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

5) Gas feed system is more complex in terms of design as compared to the turbo pump system. Given statement is: 1 point

- True
 False

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

6) Which of the following is NOT a suitable design criterion for gas pressure feed system: 1 point

- Low molecular weight gas
 Minimum gas weight
 High molecular weight gas
 None of these

No, the answer is incorrect.
Score: 0
Accepted Answers: High molecular weight gas

7) A impinging injection system is used to inject a liquid having density of 900 kg/m³ with injection pressure drop of 1.5 MPa and discharge coefficient of 0.76. The discharged velocity of the liquid is: 1 point

- 57.7 m/s
 43.9 m/s
 86.2 m/s
 32.6 m/s

No, the answer is incorrect.
Score: 0
Accepted Answers: 43.9 m/s

8) The shape of the combustion chamber affects: 1 point

- Pressure loss
 Heat transfer rate
 weight
 All of the mentioned above

No, the answer is incorrect.
Score: 0
Accepted Answers: All of the mentioned above

9) Which of the following is NOT a desirable operating condition to ensure uniform combustion and to protect chamber wall from excessive heating: 1 point

- ensuring better mixing of fuel and oxidizer in the central portion of combustion chamber
 maintaining heterogeneous mixture at the exit of combustion
 confining the intense burning of propellants near to the wall of combustion chamber
 None of these

No, the answer is incorrect.
Score: 0
Accepted Answers: confining the intense burning of propellants near to the wall of combustion chamber

10) Which of the following zone is heterogeneous in nature containing liquid, its vapor along with combustion products: 1 point

- Injection atomization zone
 Rapid combustion zone
 Stream tube combustion zone
 None of these

No, the answer is incorrect.
Score: 0
Accepted Answers: Injection atomization zone

11) Consider the following problem statement to answer questions from Q.11-15 1 point

A liquid-propellant rocket engine is used to develop a thrust of 8000 N with characteristic velocity and thrust coefficient of 1650 m/s and 1.2 respectively along with the mixture ratio of 1.8. The propellant supply pressure in the propellant tank is 4 MPa. The fuel with density of 1200 kg/m³ is stored in the propellant tank at a pressure of 0.8 MPa and the oxidizer with density of 850 kg/m³ is stored at 0.4 MPa. An injection system with 8 orifices is used having discharge coefficient of 0.7 and 0.8 for fuel and oxidizer respectively.

The I_{sp} of the rocket engine is:

- 132.4 s
 201.8 s
 254.6 s
 332.7 s

No, the answer is incorrect.
Score: 0
Accepted Answers: 201.8 s

12) The mass flow rate of fuel is: 1 point

- 1.44 kg/s
 2.18 kg/s
 2.86 kg/s
 3.62 kg/s

No, the answer is incorrect.
Score: 0
Accepted Answers: 1.44 kg/s

13) The mass flow rate of oxidizer is: 1 point

- 3.9 kg/s
 6.5 kg/s
 2.6 kg/s
 5.1 kg/s

No, the answer is incorrect.
Score: 0
Accepted Answers: 2.6 kg/s

14) The diameter of the fuel orifice is: 2 points

- 1.34 mm
 1.93 mm
 2.54 mm
 3.36 mm

No, the answer is incorrect.
Score: 0
Accepted Answers: 1.93 mm

15) The diameter of the oxidizer orifice is: 2 points

- 3.64 mm
 3.16 mm
 2.57 mm
 1.68 mm

No, the answer is incorrect.
Score: 0
Accepted Answers: 2.57 mm

16) Consider the following problem statement to answer questions from Q.16-17 2 points

Fuel and oxidizer stream with mass flow rate of 1.2 kg/s and 2 kg/s respectively are impinging at an angle of 45° and 30° respectively to the normal of the impinging wall. The velocity of fuel and oxidizer through its orifices are 40 m/s and 30 m/s respectively.

After mixing, impinging jet will move at an angle of:

- 2.62°
 3.86°
 4.74°
 6.48°

No, the answer is incorrect.
Score: 0
Accepted Answers: 2.62°

17) For better performance, what should be the new impinging angle for oxidizer if fuel impinging angle is kept constant at 45°? 1 point

- 18.5°
 23.6°
 34.5°
 40.8°

No, the answer is incorrect.
Score: 0
Accepted Answers: 34.5°