

Unit 8 - Week 6: Types of Propellant & its Selection, Multi-staging of rocket and SRPE

Course outline

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Week 2: Thermochemistry,Thrust Equation & Performance Parameters of Rocket Engine

Week 3: Nozzle Characteristics

Week 4: Characteristic Parameters of Rocket Nozzle

Week 5: Flight Trajectory & Elements of Orbital Mechanics

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

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● Lesson 29: Solid & Composite Propellants

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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

Week 11: Feed System, Ignition System, Combustion Instability & Cooling System in LPRE

Week 12: Hybrid Propellant Rocket Engine and Non-chemical Rocket Engine

Week 6: Assignment

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

Due on 2019-09-11, 23:59 IST.

1) Final velocity of an n stages launch system is the average of the velocity gains from each stage. Given statement is: 1 point

- True
 False

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

2) With respect to chemical propellants, low molecular weight of combustion product leads to high exhaust velocity. Given statement is: 1 point

- True
 False

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

3) Nitro cellulose is a type of single base heterogeneous solid propellant. Given statement is: 1 point

- True
 False

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

4) The work of the stabilizer in double base solid propellant is to counteract the auto catalytic decomposition of major constituent. Given statement is: 1 point

- True
 False

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

5) Acetone or alcohol can be used as a solvent in manufacturing of double base solid propellant. Given statement is: 1 point

- True
 False

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

6) At high % of RDX, the combustion products contain low % of H_2O and O_2 which reduced the erosion rate of C containing nozzle materials. Given statement is: 1 point

- True
 False

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

7) In a typical NC-NG double base propellant, NC and NG are used as fuel and oxidizer respectively. Given statement is: 1 point

- True
 False

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

8) Composite propellants usually contains 60-72% of binder (fuel) including its plasticizer. Given statement is: 1 point

- True
 False

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

9) Carbon particle gets reduced with increase in RDX. Given statement is: 1 point

- True
 False

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

10) Cast double base propellant has wider range of burning rate as compared to the extruded double base propellant. Given statement is: 1 point

- True
 False

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

11) Consider the following problem statement to answer questions from 11-14 1 point

A single stage chemical rocket with $I_{sp}=290$ s is designed to escape with following mass: m_l = payload mass = 240 kg; m_s = structural mass = 860 kg; m_0 = total mass = 32,000 kg. Also, neglect drag effect.

The value of mass ratio (MR) is:

- 17.43
 23.56
 29.09
 34.82

No, the answer is incorrect.
Score: 0
Accepted Answers: 29.09

12) The value of velocity increment (ΔV) is: 1 point

- 7.8 km/s
 9.6 km/s
 5.4 km/s
 11.4 km/s

No, the answer is incorrect.
Score: 0
Accepted Answers: 9.6 km/s

13) The value of propellant mass fraction is: 1 point

- 78.88 %
 86.46%
 91.54%
 96.56%

No, the answer is incorrect.
Score: 0
Accepted Answers: 96.56%

14) The value of structural mass fraction is: 1 point

- 2.68%
 5.44%
 8.48%
 12.36%

No, the answer is incorrect.
Score: 0
Accepted Answers: 2.68%

15) Consider the following problem statement to answer questions from 15-18 1 point

The specific impulses of the first and second stages of a two-stage rocket engine are 280 and 340 s, respectively. The mass of each stage is as follows:

First-stage propellant mass = 140,000 kg

First-stage structural mass = 9,500 kg

Second-stage propellant mass = 31,000 kg

Second-stage structural mass = 3,250 kg

Payload mass = 3,200 kg

Also, neglect drag effect

Payload mass fraction of stage I:

- 1.71 %
 3.81%
 6.59%
 8.68%

No, the answer is incorrect.
Score: 0
Accepted Answers: 1.71 %

16) Structural mass fraction of stage II: 1 point

- 4.54%
 8.67%
 12.44%
 14.56%

No, the answer is incorrect.
Score: 0
Accepted Answers: 8.67%

17) Propellant mass fraction of stage II: 1 point

- 72.78%
 77.54%
 82.77%
 88.52%

No, the answer is incorrect.
Score: 0
Accepted Answers: 82.77%

18) Total velocity gained by the rocket engine is: 3 points

- 7.64 km/s
 9.65 km/s
 5.94 km/s
 11.94 km/s

No, the answer is incorrect.
Score: 0
Accepted Answers: 9.65 km/s

19) As a system engineer of a space mission, you are asked to calculate the required mass of propellant which must be carried if the 2.5 points
system is to produce a total velocity of 1800 m/s to put a 1,000 kg satellite in a low earth orbit. The single stage spacecraft's dry mass is 8,000 kg and the effective exhaust gas velocity of its main engine is 2800 m/s. What would be estimated value of propellant mass:

- 17116.2 kg
 12456.4 kg
 10243.5 kg
 8116.2 kg

No, the answer is incorrect.
Score: 0
Accepted Answers: 8116.2 kg

20) You have been given a tasked to design maneuver of a 7,000 kg spacecraft which is revolving around earth orbit in a low earth orbit with orbital velocity of 7,200 m/s. The task is to put the satellite in an escape trajectory with final velocity of 12,000 m/s. The maneuver is performed by burning its engine which expels the mass at a rate of 14 kg/s with effective velocity of 2,800 m/s. According to you, what would be the duration of burn of the engine: 2.5 points

- 240 s
 320 s
 410 s
 540 s

No, the answer is incorrect.
Score: 0
Accepted Answers: 410 s