

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
EIGHTH SEMESTER B.TECH DEGREE EXAMINATION(S), OCTOBER 2019

Course Code: ME462
Course Name: PROPULSION ENGINEERING

Max. Marks: 100

Duration: 3 Hours

PART A

Answer any three full questions, each carries 10 marks.

Marks

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| 1 | (a) Distinguish between air breathing engines and rocket engines. Give examples. | (7) |
| | (b) What are applications of rocket engines. | (3) |
| 2 | (a) Discuss the working of turboprop engine. | (7) |
| | (b) Why the use of turboprop engines is limited to aircrafts having flight speed less than about 700 km/hour? | (3) |
| 3 | (a) Derive an expression for finding out the thrust developed by a jet engine. | (7) |
| | (b) What is the effect of flight speed on the thrust power of a jet engine. | (3) |
| 4 | A turbojet inducts 50 kg/s of air and propels an aircraft at a flight speed of 900km/hr. The isentropic enthalpy change for the nozzle is 200 kJ/s and velocity coefficient is 0.94. The fuel air ratio is 0.012. The calorific value of fuel is 45 MJ/kg. Calculate (i) thermal efficiency (ii) Thrust power (iii) propulsive efficiency (iv) overall efficiency | (10) |

PART B

Answer any three full questions, each carries 10 marks.

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| 5 | (a) What are the various components of turbojet engine? Explain the need of each component in detail | (6) |
| | (b) What are the limitations of thrust augmentation of turbojet engines? | (4) |
| 6 | (a) Explain the following phenomenon happened in the axial flow compressor (a) surging (b) choking (c) stalling? Also explain the effects of these phenomenon on the working of axial flow compressor | (10) |
| 7 | (a) What are the various types of rocket propulsion system? | (4) |
| | (b) Calculate the thrust, specific impulse, propulsive, thermal and overall efficiency of rocket engine from the flowing data: Effective jet velocity=1250 m/sec, flight to jet speed ratio=0.8, oxidizer flow rate=3.5 kg/sec, fuel flow rate=1 kg/sec, heat of reaction per kg of exhaust gases=2500 kJ/kg | (6) |
| 8 | (a) What are hypergolic propellants? List out the various hypergolic propellants | (3) |
| | (b) Define the propulsive efficiency and thermal efficiency of rocket propulsion | (3) |

system

- (c) What is restrictive and unrestrictive modes burning of solid propellant. (4)

PART C

Answer any four full questions, each carries 10 marks.

- 9 (a) Explain the working of pressure-fed and pump-fed LPR? (6)
- (b) Explain the working of pyrogen igniter. (4)
- 10 (a) List out any 5 desirable properties of a liquid propellant (5)
- (b) What do you mean by Combustion instability in Rocket engines (5)
- 11 Explain the different methods of cooling of thrust chambers and nozzles in Liquid propellant Rocket engine. (10)
- 12 A rocket-propelled vehicle has a mass ratio of 0.10. The specific impulse of the rocket is 2500Ns/kg. If the rocket burns for 60s, find the velocity and altitude attained by the vehicle. Assume vertical trajectory and negligible drag, $g=9.81 \text{ m/s}^2$. (10)
- 13 (a) Explain the major components of a typical rocket test facility. (6)
- (b) Explain the safety provisions in a modern rocket test facility. (4)
- 14 (a) Derive an expression for altitude gain in a powered flight. (6)
- (b) List out at least eight physical quantities measured in rocket testing. (4)
