

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**EIGHTH SEMESTER B.TECH DEGREE EXAMINATION, MAY 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

- |   |   |      |
|---|---|------|
| 1 | (a) Explain the working of pulsejet engines   | (7)  |
|   | (b) Why the use of pulsejet engines is restricted to pilot less aircrafts   | (3)  |
| 2 | (a) Explain the working of a turbofan engine  | (7)  |
|   | (b) How turbofan engine is different from turbojet engine   | (3)  |
| 3 | (a) On a T-S diagram draw the various processes occurring in a turbojet engine. Draw both ideal and actual processes.   | (7)  |
|   | (b) The isentropic efficiency of a turbine is more than that of a compressor. Substantiate this statement.  | (3)  |
| 4 | A turbojet engine takes in 30 kg/s of air and expands the gases through the jet nozzle. The pressure of the gas leaving the nozzle is equal to ambient pressure. The fuel air ratio is 0.012 and flight velocity is 800 km/hr. For maximum thrust power determine (i) thrust (ii) thrust power (iii) TSFC (iv) propulsive efficiency (v) thermal efficiency | (10) |

**PART B**

*Answer any three full questions, each carries 10 marks.*

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|---|--|-----|
| 5 | (a) What are the thrust augmentation methods used in turbojet engines? Which method is preferred for the long-range operations of turbojet engine            | (7) |
|   | (b) Explain the difference between the impulse turbine and reaction turbine  | (3) |
| 6 | (a) Which type of compressor is preferred for the aircraft gas turbine engine? Why?  | (4) |
|   | (b) Explain the types of combustion chambers used in a turbojet engine with neat sketches  | (6) |
| 7 | (a) Explain the working of hybrid rocket propulsion system? What are the advantages of hybrid rocket propulsion system?                                      | (4) |
|   | (b) A rocket has the following data: Propellant flow rate=0.5 kg/sec, Nozzle exit diameter=10 cm, Nozzle exit pressure=1.02 bar, Ambient pressure=1.013 bar, | (6) |

thrust chamber pressure=20 bar, Thrust 7 kN, determine the effective jet velocity, actual jet velocity, specific impulse and SPC.

- 8 (a) Explain the working of electric rocket propulsion system with neat sketch? (5)  
What are the advantages and disadvantage of solar rockets?
- (b) What are the various types of grain configurations used in rocket motors. (5)

### PART C

*Answer any four full questions, each carries 10 marks.*

- 9 Explain combustion instability in rocket engines? How can instabilities be controlled? (10)
- 10 Describe the combustion process in liquid and solid propellant rockets. (10)
- 11 (a) Explain the working of a hybrid rocket engine with a neat sketch (5)  
(b) What are the precautions in handling liquid propellants? (5)
- 12 (a) What is meant by multi-staging of rocket vehicles? Write the equation for maximum velocity increment a three-stage vehicle can attain in a gravity free vacuum environment. (5)
- (b) What are the different types of tests rocket propulsion systems are subjected to before put into operational use? (5)
- 13 Derive rocket equation for a rocket in gravity-free, drag-free flight. (10)
- 14 A rocket has to deliver a payload of 1000 kg. The initial mass is 15000kg and the structural mass is 3000kg. The exhaust velocity ( $V_J$  or  $I_{sp} g_e$ ) is 3000m/s. Find the Velocity increment ( $\Delta V$ ) required if  
(i) it is a single stage (ii) it is a two stage with identical stages.  
Compare the results and state which is better.

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