



**M.TECH DEGREE EXAMINATIONS: APRIL / MAY 2024**

(Regulation 2018)

Second Semester

**DEFENCE TECHNOLOGY**

P18DTT2009: Aerospace Propulsion

**COURSE OUTCOMES**

**CO1:** Knowledge about thermodynamics and fluid dynamics behind the aerospace system.

**CO2:** Understanding of Rocket motor design

**CO3:** Understanding of different design aspects related to propulsion systems used in aerospace.

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions: -**

**PART A (10 x 1 = 10 Marks)**

1. Rearrange the following turbojet with afterburner engine components. CO1 [K<sub>1</sub>]  
1. Combustor 2. Turbine 3. Afterburner 4. Intake 5. Compressor 6. Nozzle
  - a) 2-3-4-1-5-6
  - b) 1-3-6-4-5-2
  - c) 3-4-5-1-2-6
  - d) 4-5-1-2-3-6
2. Water-injection is a technique for CO1 [K<sub>2</sub>]
  - a) Thrust augmentation
  - b) Thrust reversal
  - c) Flame tube cooling
  - d) Thrust vectoring
3. The ratio of flight speed to the exhaust velocity for maximum possible propulsion efficiency is CO1 [K<sub>2</sub>]
  - a) 0.0
  - b) 0.5
  - c) 1.0
  - d) 2.0
4. Matching type item with multiple choice code CO1 [K<sub>2</sub>]

Engine	Operating Mach number
A. Turboprop	i)0.9
B. Turbofan	ii)4
C. Turbo jet	iii)2



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|-----|--|-----|-------------------|
| 16. | What is mean by stoichiometric air fuel ratio?                     | CO2 | [K <sub>2</sub> ] |
| 17. | What is meant by stage in axial flow compressor?                   | CO3 | [K <sub>2</sub> ] |
| 18. | Define degree of reaction.   | CO3 | [K <sub>1</sub> ] |
| 19. | Define CFD and mention its applications.                           | CO3 | [K <sub>2</sub> ] |
| 20. | Differentiate between finite difference and finite volume method . | CO3 | [K <sub>2</sub> ] |

**PART C (6 x 5 = 30 Marks)**

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|-----|---|-----|-------------------|
| 21. | Construct P-v and T-s diagram of an ideal Otto cycle and derive its thermal efficiency.                       | CO1 | [K <sub>3</sub> ] |
| 22. | With neat sketch explain the working principle of jet engine.   | CO1 | [K <sub>2</sub> ] |
| 23. | Define burning rate and explain the working principle of standard strand burner for burning rate measurement. | CO2 | [K <sub>2</sub> ] |
| 24. | With neat sketch briefly discuss about modified Brayton cycle.  | CO2 | [K <sub>2</sub> ] |
| 25. | Draw the velocity triangle of axial flow compressor and explain the working principle for the same.           | CO3 | [K <sub>2</sub> ] |
| 26. | Briefly discuss about the different steps in CFD Process.   | CO3 | [K <sub>3</sub> ] |

**Answer any FOUR Questions  
PART D (4 x 10 = 40 Marks)**

- |     |   |     |                   |
|-----|---|-----|-------------------|
| 27. | Draw the P-v and T-s diagram for ideal Brayton cycle and derive its thermal efficiency.   | CO2 | [K <sub>3</sub> ] |
| 28. | A turbojet engine aircraft flies with a velocity of 260 m/s at an altitude where the air is at 35kPa & -40°C. The compressor has pressure ratio of 10 & the temperature of gases at turbine inlet is 1100°C. Air enters at compressor at a rate of 45 kg/s .Utilizing the cold air standard assumptions .Determine 1.Temperature and pressure of gases at turbine exit .2. The velocity of the gases at the nozzle exit .3.The propulsive efficiency. | CO1 | [K <sub>4</sub> ] |
| 29. | Derive the general thrust equation for a propulsive system.   | CO1 | [K <sub>3</sub> ] |
| 30. | With neat sketch explain the working principle of liquid rocket propulsion system.  | CO2 | [K <sub>2</sub> ] |
| 31. | In a Brayton cycle-based power plant the air at the inlet is 27°C,0.1MPa, the pressure ratio is 6.25 and the maximum temperature is 800°C. Find the (a)compressor work (b)turbine work (c)heat supplied and (d)thermal efficiency.  | CO3 | [K <sub>3</sub> ] |

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