Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

SEMESTER-II, M. TECH (DEFENCE TECHNOLOGY)

END-SEMESTER EXAMINATION, MAY, 2024

COURSE: AEROSPACE PROPULSION (AAE 5277)

Duration: 3 Hrs **Date: 05/05/2024** **MAX. MARKS: 50**

Note:

- *All questions are compulsory*
- *Draw a neat diagram wherever necessary*
- *Stepwise answers carry marks*
- *Missing data may be suitably assumed.*

Q. No.	Question	Marks	Course Outcome	BT Level
Q1.	What is the significance of compressible flow assumption in solving propulsion problems? Justify it.	**[3M]**	**CO1**	**C**
Q2.	What does this equation represent? $\rho_1 u_1 A_1 = \rho_2 u_2 A_2$ What are the underlying assumptions that are considered for arriving at this formulation?	**[3M]**	**CO1**	**B**
Q3.	Apply the one dimensional nozzle equation to describe the design of a nozzle & diffuser at various flow regimes. How the backflow effects the flow in a convergent nozzle? Explain with a neat figure.	**[4M]**	**CO1**	**C**
Q4.	Explain the difference between the can and cannular type of subsonic combustion chambers used in a jet engine.	**[3M]**	**CO2**	**B**
Q5.	Explain the design and significance of Bell nozzle over the traditional cone nozzle. How does the divergence angle influence both the nozzle design considerations? Since the nozzle is designed for one altitude, how do you think it can be modified to address the varying altitudes?	**[5M]**	**CO2**	**C**
Q6.	Differentiate between axial compressors and axial turbines.	**[3M]**	**CO2**	**B**

Q7.	Describe with a neat diagram, the construction and working of turbofan and turboprop engines. Which of the two will have higher propulsive efficiency? Justify.	**[4M]**	**C02**	**B**
Q8.	Explain how the thrust is estimated from the rocket motor? How is it different from the equation of thrust for a basic jet engine?	**[3M]**	**CO3**	**C**
Q9.	Describe the desirable properties of a good propellant which differentiates the liquid from solid propellants?	**[3M]**	**CO3**	**B**
Q10.	Distinguish between the case bonded and cartridge loaded propellant grain configurations. Which one is commonly used and why?	**[3M]**	**CO3**	**B**
Q11.	Describe with a schematic diagram the 'V' model of system engineering approach	**[4M]**	**CO4**	**B**
Q12.	Explain the 6 functions of a design process adopted in system integration.	**[3M]**	**CO4**	**B**
Q13.	Bell lab has developed a new plasma propulsion system for mars. You are tasked to develop the approach to provide a detailed plan of action for its development. Will you use horizontal integration or vertical integration method for development of a new propulsion system? Explain your choice with reasons. Also provide the advantages of your choice and disadvantages of the other methods.	**[4M]**	**CO4**	**E**
Q14.	The royal airforce is having a peculiar issue of the poor fixed wing design which is based on RAF 34 1496 airfoil. It was found to be producing more drag. The committee has suggested to evaluate the NACA23012 airfoil profile. You are tasked to prepare the outline for a CFD simulation. Explain to the committee the steps you will follow to carry out the CFD simulation. How will CFD compare the two airfoils?	**[5M]**	**CO5**	**E**