

# Subject Code: KME064

**Roll No:** 

## **BTECH**

# (SEM VI) THEORY EXAMINATION 2023-24

GAS DYNAMICS AND JET PROPULSION

# **TIME: 3 HRS**

**M.MARKS: 100** 

Note: 1. Attempt all Sections. If require any missing data; then choose suitably. **SECTION A** 

#### 1. Attempt all questions in brief.

### $2 \ge 10 = 20$

	SECTION	
	SECTION B	A
j.	What is monopropellant? Give one example	02
i.	What do you mean by By-Pass ratio in Turbofan engines.	02
h.	Explain essential components of turbojet engines	02
g.	What is Escape velocity.	02
f.	Explain over-expanded and under expanded flow	02
e.	What are conditions to be satisfied by Fanno Flow	02
d.	State the reason for development of shock wave in nozzle.	02
c.	Express the stagnation enthalpy in terms of static enthalpy and velocity of flow?	02
b.	Differentiate nozzle and diffuser.	02
a.	State the term compressibility effect.	02

# SECTION B

#### 2. Attempt any three of the following:

 $3 \ge 10 = 30$ Derive the expression for stagnation to static temperature ratio and Mach number 10 a. of flow. Draw the variation of Mach number along the length of a convergent-divergent duct b. 10 when it acts as a (a) Nozzle (b) Diffuser (c) Venturi Prove that the Mach number of FANNO LINE for maximum entropy is 1. 10 c. With a neat sketch & thermodynamic cycle explain the working RAMJET engine and 10 d. derive the equation for thrust developed What are the advantages and disadvantages of liquid propellants compared to solid 10 e. propellants

# SECTION C

#### 3. Attempt any one part of the following:

## $1 \ge 10 = 10$

a.	Show that for sonic flow the deviation between the compressible and	10
	incompressible flow values of the pressure coefficient of a percent gas ( $\gamma$ =1.4) is	
	about 27.5 percent	
b.	Derive the following relations for one-dimensional isentropic flow:	10
	$p^{*}/p = [2/(\gamma+1) + (\gamma-1/\gamma+1)M^{2}]$	
4.	Attempt any one part of the following:1 x 10	) = 10
a.	Examine the variation of Mach number, static and stagnation pressure across a normal shock	10
b.	The effective jet exit velocity from a jet engine is 2700m/s. The forward flight speed	10
	is 1350m/s and airflow rate is 78.6 kg/s. solve for following	
	a. Thrust	
	b. Thrust power	
	c Propulsive efficiency	



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5.	Attempt any one part of the following:1 x	x 10 = 10
a.	Discuss in detail the various propellants used in solid fuel rockets and liquid fuel system. Also sketch the propellant feed-system for a liquid propellant rocket moto	r 10
b.	Prove that when the Rayleigh flow is subsonic (Ma<1), fluid heating ( $\delta$ qx increases fluid velocity while fluid cooling decreases fluid velocity	>0) 10
6.	Attempt any one part of the following:1 x	$x \ 10 = 10$
a.	<ul> <li>Air (γ =1.4,R=287.43 J/Kg K) enters a straight axis-symmetric duct at 300 K,3.45 k and150 m/s and leaves it at 277 k,500cm<sup>2</sup>. Assuming adiabatic flow determines:</li> <li>1. stagnation temperature,</li> <li>2. maximum velocity,</li> <li>3. mass flow rate, and,</li> <li>4. area of the cross-section at exit</li> </ul>	par 10
b.	Discuss what is meant by thrust augmentation and explain how it is affected	10
7.	Attempt any <i>one</i> part of the following:	$\mathbf{x} \ 10 = 10 \qquad 0$
a.	Discuss the working of basic components of aircraft gas turbine engines. Al draw T-S diagram of Brayton cycle.	so 10
	propellant flow rate of 5.0Kg/s. If the heat of reaction of the propellants is 6500KJ/ of the propel at mixture determine. a) Propulsion efficiency and propulsion power, b) Engine output and thermal efficiency, and c) Overall efficiency	/Kg