Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER– VI EXAMINATION – SUMMER 2026

Subject Code:3161912 Date:26-05-2026

Subject Name:Gas Dynamics

Time:10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

Q.1	**(a)**	Define Mach Number, Mach cone, and Mach angle.	**03**
	(b)	Derive the energy equation for one dimensional compressible adiabatic flow.	**04**
	(c)	Explain propagation of disturbance in compressible fluid with M =1, M<1 and M>1.	**07**
Q.2	**(a)**	Explain the phenomenon of choking in isentropic flow	**03**
	(b)	Sketch *T-S* and *h-S* diagrams for nozzles with adiabatic and isentropic flow processes	**04**
	(c)	Derive the following equation for one dimensional isentropic flow and draw the shape of nozzle and diffuser for subsonic, sonic and supersonic flow. $\frac{dA}{A} = \frac{dP}{\rho c^2}(1 - M^2)$	**07**
		OR	
	(c)	Explain the effect of varied back pressure in a convergent-divergent nozzle under isentropic flow conditions with neat sketches	**07**
Q.3	**(a)**	Differentiate between a nozzle and diffuser.	**03**
	(b)	Explain "shock condensation".	**04**
	(c)	Explain how does a shock wave develop in the diverging section of a supersonic nozzle? How does this wave move towards the exit?	**07**
		OR	
Q.3	**(a)**	Write general characteristic of normal shock	**03**
	(b)	Explain the function of a supersonic diffuser with a neat sketch.	**04**
	(c)	Starting from the energy equation for flow through a normal shock, obtain the Prandtl Mayer relation, $M^*_x M^*_y = 1$	**07**
Q.4	**(a)**	Define Fanning's coefficient of friction and hydraulic diameter.	**03**
	(b)	Write a note on Fanno curve with neat sketches.	**04**
	(c)	Explain the direction of isothermal flow process with friction with neat T-s diagram.	**07**
		OR	
Q.4	**(a)**	What is Fanno flow? Write governing equations for Fanno flow.	**03**
	(b)	Derive expression for pressure ratio, temperature ratio and velocity ratio for the Fanno flow of a perfect gas.	**04**
	(c)	Draw the Fanno curve on h-s diagram and discuss the effect of friction in case of subsonic and supersonic flow. What is the limiting value of Mach number?	**07**
Q.5	**(a)**	Write continuity and momentum equations for the Rayleigh flow process and show its plot on the (*h-s*) diagram.	**03**
	(b)	What is Rayleigh flow? Give two practical examples.	**04**
	(c)	Explain the expansion and compression both adiabatically and isentropically with the help of T-s and P-V diagrams.	**07**
		OR	
Q.5	**(a)**	State the four assumptions of Rayleigh flow.	**03**
	(b)	Differentiate between open and closed-circuit wind tunnels .	**04**

(c) Derive the equation of maximum non-dimensional heat transfer rate in Rayleigh flow process. Also obtain the value of supersonic mach number for the same maximum heat transfer **07**

****