Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VII (NEW) EXAMINATION – WINTER 2020

Subject Code:2170106 **Date:28/01/2021**

Subject Name:Boundary Layer Theory

Time:10:30 AM TO 12:30 PM **Total Marks: 56**

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Draw a path lines for laminar and turbulent flows.	**03**
	(b)	Draw a profile transition from laminar to turbulent flow.	**04**
	(c)	List out different types of wind tunnel and draw open type subsonic windtunnel	**07**
Q.2	**(a)**	Write characteristics of Laminar flow.	**03**
	(b)	Write characteristics of Turbulent flow.	**04**
	(c)	Derive Couette flow equation with neat sketch.	**07**
Q.3	**(a)**	Define Laminar Sublayer.	**03**
	(b)	What is Boundary layer control?	**04**
	(c)	Derive orr-sommer field equation.	**07**
Q.4	**(a)**	Define Displacement thickness with sketch.	**03**
	(b)	Define momentum thickness and Energy thickness.	**04**
	(c)	Derive an expression for the Darcy weisbach equation for turbulent boundary layer flow	**07**
Q.5	**(a)**	Explain flow over a flat plate for Turbulent flow.	**03**
	(b)	Explain thermal boundary layer growth over the hot surface.	**04**
	(c)	Draw an effect of viscosity on an airfoil in a moving fluid.	**07**
Q.6	**(a)**	Explain Reynolds analogy.	**03**
	(b)	Determine the wall shearing stress in a pipe of diameter 100mm which carries water. The velocities at the pipe centre and 30mm from the pipe centre are 2 m/s and 1.5 m/s respectively. The flow in pipe is given as Turbulent	**04**
	(c)	Derive Momentum equations for boundary layer by von karman	**07**
Q.7	**(a)**	Define critical Reynolds number.	**03**
	(b)	What is Prandtl mixing length theory?	**04**
	(c)	Derive governing equation for Turbulent flow.	**07**
Q.8	**(a)**	Explain flow over a Cylinder for Laminar flow.	**03**

(b) A thin plate is moving in still atmospheric air at a velocity of 5m/s. The length of the plate is 0.6 m and width 0.5m. **04**

Calculate 1. The thickness of the B.L at the end of the Plate

2. Drag force on one side of the plate

Take Density of air as 1.24 kg/m^3

Kinematic viscosity 0.15 stokes

(c) Derive velocity distribution for turbulent flow in smooth pipe. **07**