Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER-1 (NEW) EXAMINATION – WINTER 2016

Subject Code: 2711103 **Date:05/01/2017**

Subject Name: Advance Fluid Mechanics

Time: 2:30 pm to 5:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Derive the basic Navier-Stokes equation.	**07**
	(b)	Define terms: 1) vorticity 2) circulation 3) velocity potential function 4) stream function 5) irrotational flow 6) internal stress 7) viscosity	**07**
Q.2	**(a)**	Derive Bernoulli's equation with usual notations.	**07**
	(b)	Explain principle of Superposition and give its application.	**07**
		OR	
	(b)	Derive Euler's equation of motion.	**07**
Q.3	**(a)**	Explain stokes and Ossen approximation with example.	**07**
	(b)	Derive boundary layer equation using approximate method.	**07**
		OR	
Q.3	**(a)**	Using momentum integral technique of boundary layer, derive Karman integral equation.	**07**
	(b)	Explain the mechanism of transition to turbulence and factors affecting it with remedy to control it.	**07**
Q.4	**(a)**	Air enters a diffuser with a velocity of 200 m/s. Determine (1) the speed of sound and (2) the mach number at the diffuser inlet when the air temperature is 30 °C.	**07**
	(b)	Explain eddy viscosity concepts for turbulent flow. Also compare it for laminar flow using sketch of velocity gradients.	**07**
		OR	
Q.4	**(a)**	Derive Prandtl's mixing length equation.	**07**
	(b)	CO gas flows steadily through a varying cross-sectional area duct (nozzle) with mass flow rate of 3 Kg/s. The CO enters the duct at a pressure of 1400 kPa and 200 °C with a low velocity and it expands in the nozzle to a pressure of 200 kPa. The nozzle is designed so that the flow can be approximated as isentropic. Determine the density, velocity, flow area and Mach number at exit. Take C_p = 0.846 kJ/kg K, R= 0.1889 kJ/Kg K and γ=1.289.	**07**
Q.5	**(a)**	Explain normal shock using h-s diagram and compare with Fanno line and Rayleigh line.	**07**
	(b)	Explain chocked Rayleigh flow with example.	**07**
		OR	
Q.5	**(a)**	Write note on characteristics nature of turbulent flow.	**07**
	(b)	Define: Sonic flow, Supersonic flow, Mach cone, Stagnation pressure, Shock strength.	**07**

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