Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER– I (OLD course)• EXAMINATION – SUMMER 2015

Subject Code: 711201 **Date: 11/05/2015**

Subject Name: ADVANCED FLUID MECHANICS

Time: 10:30 am to 1:00 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)**	What are the various laws assumed for velocity distribution in laminar boundary layer? Derive expression for ŭ, Ŭ and Cd when velocity distribution is u/U = y/ŭ.	**07**
	(b)	The wings of a model aeroplane are tested in a wind tunnel under atmospheric pressure and at a wind velocity of 2.6 m/s. The aerofoil wing may be taken as equivalent to a flat plate of length 180mm and of width 600mm. Determine (a) the boundary layer thickness at the trailing edge and (b) the drag force exerted by the wind.Take for air density = 1.22 kg/m^3 and kinematic viscosity = 1.5*10^{-5} m^2/s.	**07**
Q.2	**(a)**	What is skin drag? Obtain general equation for the force exerted on a body placed in a moving fluid.	**07**
	(b)	A 2 meter wide 5 meter long plate moves through stationary air of density 1.22 kg/m3 and viscosity 1.8*10^{-5} N-s/m^3 at the velocity of 1.75 m/s parallel to its length. Determine the drag force on one side of the plate (a) assuming laminar flow condition (b) assuming turbulent flow condition.	**07**
		OR	
	(b)	Show that the kinematic energy correction factor is 2 for viscous flow through a circular pipe.	**07**
Q.3	**(a)**	Obtain an expression for the discharge between two parallel plates assuming two dimensional laminar flow.	**07**
	(b)	What is the universal law of resistance? Obtain an expression for coefficient of pipe friction f for smooth and rough pipes.	**07**
		OR	
Q.3	**(a)**	Derive Navier Stokes equation.	**07**
	(b)	Derive the nonï uniform flow equation.	**07**
Q.4	**(a)**	Differentiate between backwater curve and drawdown curve.	**07**
	(b)	How the length of backwater curve is estimated?	**07**
		OR	
Q.4	**(a)**	Write short note on surges in open channel.	**07**
	(b)	What do you mean by water hammer? Explain water hammer analysis in brief.	**07**
Q.5	**(a)**	A Rectangular channel 5 m wide conveys a discharge of 16 m3/s of water at a depth of 2 m. If the width of the channel is reduced to 3.5 m on the down stream side will the water surface in the channel be disturbed? What will be the depth of flow in the reduced section?	**07**
	(b)	Water flows in a rectangular channel at a velocity of 1.2 m/s at a depth of 0.75 m. If the gate at the downstream end of the channel is suddenly closed find the resulting surge conditions.	**07**
		OR	
Q.5	**(a)**	Explain spatially varied flow.	**07**
	(b)	Describe F E M to transient flow in open channels.	**07**