Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER I (OLD) – • EXAMINATION – SUMMER 2016

Subject Code: 711201N **Date:16/05/2016**

Subject Name: ADVANCED FLUID MECHANICS

Time:02:30 pm to 05:00 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 is meant by separation of boundary layer? How is the separation point determined? State the reasons for separation.	**07**
	(b)	Sketch the possible GVF profiles in the following serial arrangement of channels. (I) steep-mild-steep (ii) mild-steep-mild (iii) mild-sluice gate mild-drop.	**07**
Q.2	**(a)**	Describe positive and negative surges of the channel .	**07**
	(b)	Explain channel transitions and obtained condition to determine u/s depth of the channel transition.	**07**
		OR	
	(b)	What is skin drag? Derive general equation for the force exerted on a body placed in a moving fluid	**07**
Q.3	**(a)**	Explain the direct integration procedure for computing the GVF profiles and obtain the Bress's function.	**07**
	(b)	The normal depth of flow of water in a rectangular channel 1.5 m wide is one meter. The bed slop of the channel is 0.0006 and Manning's roughness coefficient n = 0.012 . Find the critical depth. At a certain section of the same channel the depth is 0.92 m while at a second section the depth is 0.86 m. Find the distance between the two sections. Also find whether the section is located downstream or upstream with respect to the first section.	**07**
		OR	
Q.3	**(a)**	What is FEM? Explain how the FEM is applied for transient flow in open channel.	**07**
	(b)	A rectangular flume 2m wide carries discharge at the rate of 2 m^3/s. The bed slope of the flume is 0.0004 . At a certain section the depth of flow is 1 m. Find the distance of the section downstream where the depth of flow is 0.9m. Solve by direct step method. Assume rogosity coefficient as 0.014 . Is the slop of the channel mild or steep ? How is this type of surface profile classified.	**07**
Q.4	**(a)**	Obtain Von Karman momentum integral equation.	**07**
	(b)	A fluid of dynamic viscosity of 1 poise is filled between two horizontal plates 15 mm apart. If the upper plate is moving at 1.5 m/s with respect to lower plate which is fixed and the pressure difference between two section 100 m apart is 50 kN/m^2. Calculate (a) The velocity distribution (b) Discharge per unit width and (c) The shear stress at upper plate.	**07**
		OR	
Q.4	**(a)**	Starting from N.S. equation derive an expression for velocity distribution, shear force and discharge for the laminar flow between two parallel plates.	**07**
	(b)	The hydrodynamically rough pipe of diameter 40 cm having turbulent flow, the centerline velocity is 3 m/s and the local velocity at 15 cm from pipe centre is 2.5 m/s. Find the discharge and the height of the roughness projections	**07**
Q.5	**(a)**	Explain Prandtl's mixing length theory.	**07**

	(b)	Water is flowing through a pipe of diameter 0.3m and length 2 km with a velocity of 2.5 m/s. A valve is provided at the end of the pipe. If the valve is closed in 2 seconds, find the rise in pressure. Assume the pipe is rigid and take the bulk modulus of water as 2×10^9 N/m^2.	**07**

OR

Q.5	**(a)**	Explain significant of each term in Navier-stocks equation	**07**
	(b)	Explain the method of characteristics.	**07**

****