Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–III EXAMINATION – SUMMER 2016

Subject Code:X30604 **Date:03/06/2016**

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)**	Derive Bernoulli's equation of motion. List all the assumptions made.	**07**
	(b)	Explain the concept of boundary layer. Derive the expression for displacement thickness.	**07**
Q.2	**(a)**	Derive continuity equation in Cartesian coordinates for three dimensional flow.	**07**
	(b)	Discuss the specific energy curve with a neat sketch.	**07**
		OR	
	(b)	Enlist various methods for measuring the coefficient of viscosity of liquids and explain rotating cylinder method.	**07**
Q.3	**(a)**	The stream function of a two dimensional flow is given by $\psi = 2xy + 25$. Calculate the velocity at the point (1, 2). Also find the velocity potential function ϕ.	**07**
	(b)	Explain the concept of hydrodynamically smooth and rough boundaries.	**07**
		OR	
Q.3	**(a)**	Find the displacement thickness and momentum thickness for the velocity distribution in the boundary layer given by $u/U = 2(y/\delta) - (y/\delta)^2$.	**07**
	(b)	Explain the different types of similarities which must exist between model and prototype.	**07**
Q.4	**(a)**	Obtain Darcy-Weisbach formula for head loss due to friction.	**07**
	(b)	In a pipe of 200 mm diameter water is flowing, there is a shear stress of 0.12 kN/m^2 at a point distant 30 mm from the pipe axis. If the coefficient of friction between the pipe and fluid is 0.04, calculate the shear stress at the pipe wall.	**07**
		OR	
Q.4	**(a)**	Derive an expression for Hagen - Poiseuille's formula for viscous flow through circular pipe.	**07**
	(b)	An oil of specific gravity 0.9 and viscosity 0.06 poise is flowing through a pipe of diameter 200 mm at the rate of 60 liters/s. Find the head lost due to friction for a 500 mm length of pipe. Also find the power required to maintain the flow. Take $f = 0.079/(R_e)^{1/4}$	**07**
Q.5	**(a)**	Derive an expression for most economical section for a rectangular section.	**07**
	(b)	The resistance R to the motion of completely submerged body depends on length of body, velocity of flow, mass density and kinematic viscosity. Find the relation between R and other variables using suitable method.	**07**
		OR	
Q.5	**(a)**	A concrete lined circular channel of 3 m diameter has a bed slope of 1 in 500. Determine the velocity and discharge for the conditions of maximum discharge. Take, Chezy's constant, C = 50	**07**
	(b)	Describe Reynold's experiment and explain laminar and turbulent flow.	**07**

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