Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

P.D.D.C Sem-III Examination May 2011

Subject code: X30604 **Subject Name: Advanced Fluid Mechanics**

Date:27/05/2011 **Time: 10.30 am – 01.00 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)**	Develop from the first principal the continuity equation in Cartesian coordinate for three dimensional flows.	**07**
	(b)	Derive an expression for most economical section for a rectangular section.	**07**
Q.2	**(a)**	Derive an expression for gradually varied flow and state the assumptions made in it.	**07**
	(b)	Discuss the specific energy curve with a neat sketch.	**07**

OR

	(b)	Define the term stream function. How it differs by potential function	**07**
Q.3	**(a)**	Describe Rayleigh method for dimensional analysis.	**07**
	(b)	Define "Dimensional Homogeneity" and test whether following equations are dimensionally homogeneous or not. (i) $Q = 3.33LH^{\frac{3}{2}}$ (ii) $h_f = \frac{flv^2}{2gD}$ (iii) $V = \frac{1}{n} R^{\frac{2}{3}} S^{\frac{1}{2}}$	**07**

OR

Q.3	**(a)**	Describe various types of hydraulic models.	**07**
	(b)	Explain and prove Buckingham's π-Theorem.	**07**
Q.4	**(a)**	Derive the relation for laminar flow between two parallel plates the mean velocity is equal to two-third of the maximum velocity.	**07**
	(b)	Obtain an expression for the velocity distribution for turbulent flow in smooth pipe.	**07**

OR

Q.4	**(a)**	Explain the concept of boundary layer. Derive the expression for displacement thickness.	**07**
	(b)	Derive an expression for velocity for the laminar flow through circular pipe.	**07**
Q.5	**(a)**	(i) Explain Hardy Cross method of analysis of flow in pipe net works.	**04**
		(ii Explain critical, sub critical and super critical flow in an open channel.	**03**

(b) (i) Derive & Explain Euler's Equation of motion. **04**

(ii)Find the velocity & rate of flow of water through a rectangular channel of 6m wide & 3m deep, when it is running full. Bed slope 1 in2000, C=55 **03**

OR

Q.5 **(a)** (i)If the velocity distribution in the boundary layer is given by $u/U = y/\delta$ determine the displacement thickness, momentum thickness and energy thickness. **04**

(ii) The velocity in x, y and z directions are given by u= 2x-yt, v= y-zt and w= x-3z+t respectively. Determine the acceleration and velocity at point (1, 1, 2) and t=1. **03**

(b) Determine the maximum discharge of water through a circular channel of diameter 1.5m. When the bed slope of channel is 1 in 1100. Take C=60. **07**

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