Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. - SEMESTER – VI • EXAMINATION – WINTER 2012

Subject code: 160602 **Date: 03/01/2013**

Subject Name: Applied Fluid Mechanics

Time: 02.30 pm - 05.00 pm **Total Marks: 70**

Instructions:

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

Q.1 **(a)** Derive an equation for velocity distribution in viscous flow between two parallel pales. **04**

(b) Differentiate between hydro-dynamically smooth and rough boundaries. **04**

(c) Calculate the ratio of displacement thickness and momentum thickness for the velocity distribution in the boundary layer given by the following expression: **06**

$$\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$$

Where, u is the velocity at a distance y from a surface, U is a uniform free-stream velocity and δ is boundary layer thickness.

Q.2 **(a)** Explain dynamic similarity between a prototype and its model. Describe Reynolds' number and Froude's number used in the model analysis. **07**

(b) Write short note on π-theorem dimensional analysis. How repeating variables are selected in the analysis? **07**

OR

(b) The pressure difference Δp in a pipe due to viscous flow depends on the diameter of the pipe, D; length of the pipe, l; velocity of flow, v; dynamic viscosity, μ and density, ρ. Obtain an expression for Δp by performing dimensional analysis. **07**

Q.3 **(a)** Draw a typical specific energy diagram for the open channel flow and explain it. Also define critical velocity. **07**

(b) Find the width and depth of a rectangular channel to convey a discharge of 1.5 m^3/s at a velocity of 0.5 m/s. Take Chezy's constant equal to 60 and the channel bed slope equal to 0.00012. **07**

OR

Q.3 **(a)** What does it implied by a channel of 'optimum section' or 'most economical channel section'? Show that the hydraulic mean depth for such a trapezoidal channel is one-half the depth of flow. **07**

(b) A sluice gate discharges water into a horizontal rectangular channel with a velocity of 8 m/s and depth of water is 0.5 m. The width of the channel is 5 m. Determine whether a hydraulic jump will occur, and if so, find its height and **07**

corresponding loss of energy.

Q.4	**(a)**	Differentiate between impulse and reaction turbines. Explain significance of specific speed.	**07**
	(b)	Explain main parts of a centrifugal pump with a neat sketch. Discuss effects of cavitation on the performance of pumps.	**07**

OR

Q.4	**(a)**	Differentiate between natural and mechanical ventilations. State requirements of a ventilation system.	**07**
	(b)	A turbine is running at 180 rpm under a head of 30 m and the discharge is 10 m^3/s. Determine the speed, discharge and power developed by the turbine under the reduced head of 20 m. Take overall efficiency of the turbine equal to 80%.	**07**

Q.5	**(a)**	Explain concept of laminar and turbulent boundary layer growth over a flat plate. What is boundary layer separation?	**07**
	(b)	An oil of viscosity 1 poise and specific gravity 0.85 is flowing through a circular pipe of diameter 10 cm at a rate of 6 liters/s. Calculate, i) pressure drop in a length of 400 m and, ii) shear stress at the pipe wall.	**07**

OR

Q.5	**(a)**	Differentiate between stream-lined body and bluff body. Also prove that the coefficient of drag for sphere is given by $24/Re$, when Reynolds' number (Re) ≤ 0.2.	**07**
	(b)	Explain Prandtl's mixing length theory.	**07**

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