

GUJARAT TECHNOLOGICAL UNIVERSITY
M. E. - SEMESTER – I • EXAMINATION – WINTER • 2014

Subject code: 2713303**Date: 09-01-2015****Subject Name: Advanced Fluid Mechanics****Time: 02:30 pm - 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.
- 4.

- Q.1** (a) Explain briefly the classification of open channel flows. Also give examples of each type of flow. **07**
- (b) Explain Prandtl's mixing length theory. **07**

- Q.2** (a) Describe Navier-Stokes equation and its applicability in fluid flow problems. **07**

- (b) For generalized Couette flow, show that the discharge per unit width is given **07**

$$q = U \frac{h}{2} - \frac{h^3}{12\mu} \frac{dp}{dx}.$$

OR

- (b) Calculate the friction drag on a flat plate 15 cm wide and 45 cm long placed longitudinally in a stream of oil of relative density 0.925 and 0.9 stoke, flowing with a free stream velocity of 6.0 m/s. Also, find the thickness of the boundary layer and shear stress at the trailing edge. **07**

- Q.3** (a) Sketch the possible GVF profiles in the following serial arrangement of channels **07**

- (i) Steep ÷ Steeper ÷ Mild ÷ Milder slope
 (ii) Steep ÷ Horizontal ÷ Mild slope
 (iii) Mild ÷ Sluice gate ÷ Steep ÷ Horizontal ÷ Sudden drop

- (b) Write assumption in GVF and develop the gradually varied flow equation for **07**

wide rectangular channel $\frac{dy}{dx} = S_0 \left(1 - \left(\frac{y_0}{y} \right)^{\frac{10}{3}} \right) / \left(1 - \left(\frac{y_c}{y} \right)^3 \right)$ where the terms

have their usual meaning.

OR

- Q.3** (a) Explain control sections and give examples of controls in GVF with sketches. **07**

- (b) A stationary hydraulic jump occurs in a rectangular channel with the initial and sequent depths being equal to 0.20m and 1.20 m respectively. Estimate (i) discharge per unit width and (ii) the energy loss. **07**

- Q.4** (a) Explain briefly classification of flow profiles with sketches. **07**

- (b) A wide rectangular channel ($n = 0.015$) carries a flow of $2.5 \text{ m}^3/\text{s}$ per meter width. The bed slope of the channel is 0.005. Determine whether the channel slope is mild, steep or critical. **07**

OR

- Q.4** (a) Explain method of characteristics. **07**

- (b) Derive differential equation of SVF with increasing discharge. 07
- Q.5** (a) Write a short note on hydraulically smooth and rough pipes. 07
- (b) In a rough pipe of diameter 0.6 m and length 4500 m water is flowing at the rate of $0.6 \text{ m}^3/\text{s}$. if the average height of roughness is 0.48 mm find the power required to maintain the flow. 07
- OR**
- Q.5** (a) Enlist the various methods of determining the coefficient of viscosity of a liquid and describe any one method in detail. 07
- (b) Explain the separation of boundary layer, its effect on moving bodies and control measures to be taken for it. 07
