

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-VI • EXAMINATION – WINTER 2013

Subject Code: 160602**Date: 29-11-2013****Subject Name: Applied 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) Draw sketches to explain the development of boundary layer along a flat plate. Enlist the factors affecting establishment length **07**
(b) Explain the displacement and the momentum thickness **07**

- Q.2** (a) Explain the separation of boundary layer and ill effects and explain how it can be controlled **07**
(b) Write the governing equation for drawing the gradually varied flow profiles. With the help of this equation draw M_1 , M_2 and M_3 type of profiles and give examples where they occur in reality. **07**

OR

- (b) Write the procedure for locating the hydraulic jump below a sluice gate on a mild slope which exists on the down stream side for a long reach of the channel. **07**

- Q.3** (a) For a laminar flow of an oil having dynamic viscosity $\mu = 1.766$ Pa.s in a 0.3 metre diameter pipe the velocity distribution is parabolic with a maximum point velocity 3m/s at the centre of the pipe. Calculate the shear stress at 60 and 90 mm from the pipe wall. **07**
(b) Give the use of dimensional analysis in presenting experimental data and in model investigation. **07**

OR

- Q.3** (a) A smooth wrought iron pipe 0.2 metre in diameter carries crude oil at a velocity of 2.5m/s. Find the loss of head per 100 metre and the power required to maintain the flow. Take kinematic viscosity as 0.4 stokes and specific gravity as 0.90. **07**
(b) Give the merits and limitations of distorted models. **07**

- Q.4** (a) Derive the expression for Reynolds shear stress in a turbulent flow field by use of Prandtl mixing length theory and state its utility. **07**
(b) Define lift and drag. Enlist and explain the parameters on which the lift and drag forces will depend for a body placed in a flow field **07**

OR

- Q.4** (a) By the use method of dimensional analysis obtain an expression for critical depth y_c in a triangular channel, the critical depth depends upon discharge Q , acceleration due to gravity and angle of channel θ **07**
(b) Give the significance of specific speed and unit speed of turbine. Define and give examples of impulse and reaction turbines. **07**

- Q.5** (a) Distinguish between rapidly varied and gradually varied flow, steady uniform and unsteady uniform flow. Give examples of each. **07**

- (b) Air flows over a plate 1 metre long at velocity of 6m/s Determine the total drag per unit length on the sides of the plates. Take mass density of air as 1.226 kg/m^3 and kinematic viscosity as $0.15 \times 10^{-4} \text{ m}^2/\text{s}$ **07**

OR

- Q.5** (a) Discuss the variation of velocity along a vertical for turbulent flow in a rigid bed open channel **07**
- (b) A Francis turbine of 1 metre runner diameter working under a head of 5 metres at a speed of 205 rpm develops 75 kW when the rate of flow of water is $1.8 \text{ m}^3/\text{s}$. If the head on the turbine is increased to 15 metre determine the new speed ,discharge and power. **07**
