0.9 m. Solve by single step method. Assume rugosity coefficient as 0.014. Is the slope of the channel mild or steel? How is this type of surface profile classified?

7. (a) Sketch the possible gradually varied flow profiles for the following arrangement of channels and controls.

   (i) Steep-horizontal mild ending with storage

   (ii) Steep-mild-sluice gate

   (b) A hydraulic jump occurs in a 0.5 m wide rectangular channel at the point, where depth of water flow is 0.15 m and Froude number is 2.5. Calculate the specific energy, critical and sequent depths, loss of head and energy dissipated.

8. Write short notes on:

   (a) Boussinesq eddy viscosity model

   (b) Joukowsky profile

   (c) Types of hydraulic jumps and their features.

III/IV B.E. DEGREE EXAMINATION.

First Semester

Civil Engineering

FLUID MECHANICS – II

(Common with Civil Environmental Engineering and Dual Degree Programme in Civil Engineering)

(Effective from the admitted batch of 2006–2007)

Time : Three hours Maximum : 70 marks

First question is compulsory.

Answer any FOUR from the remaining.

All questions carry equal marks.

1. (a) What is difference between Couette and Poiseuille flows?

   (b) State the characteristics of laminar boundary layer.

   (c) What is Von Karman Vortex trail?

   (d) What is meant by most economical channel section?

   (e) Explain the functions of Parshall flume.

   (f) List the various types of hydraulic jump.

(g) What is canal transition?

(h) If E_{min}, in a rectangular open channel is 0.75 m. What is the discharge in $m^3/s/m$?

(i) What are the stages of development of circulation around an airfoil?

(j) What is the Magnus effect?

2. (a) Prove that the average velocity is 2/3rd of the maximum velocity for a steady laminar flow between two fixed parallel plates.

(b) Two fixed parallel plates kept 8 cm apart have laminar flow of oil between them with a maximum velocity 1.5 m/s. Taking dynamic viscosity of oil to be $\mu = 2$ N.s/m^2 Compute:

(i) The discharge per metre width

(ii) Shear stress at the plates

(iii) The pressure difference between the two points 25 m apart

(iv) Velocity at 2 cm from the plate

(v) The velocity gradient at the plates end.

3. (a) Explain the phenomena of boundary layer separation and methods of controlling it.

(b) The velocity distribution in the boundary layer is given by $\frac{u}{U} = \frac{3}{2}\frac{y}{\delta} - \frac{1}{2}\left(\frac{y}{\delta}\right)^3$, being the boundary layer thickness. Calculate:

(i) displacement thickness and

(ii) momentum thickness.

4. (a) Derive the condition for maximum discharge for a given value of specific energy

(b) A kite of surface area 0.4 m^2 flies in air making an angle of 25° with the horizontal. The weight of the kite is 1.5 N and string tension is 5 N. The string makes an angle of 70° with plane of the kite. If the wind velocity is 20 kmph, find the drag and lift coefficients of the kite. Density of air = 1.18 kg/m^3.

5. (a) Derive dynamic equation of gradually varied flow in open channel.

(b) Water enters to a rectangular channel of uniform cross section at a velocity of 8 m/s. The depth of water is 60 cm. Verify is the flow is sub critical or super critical and calculate the critical depth and corresponding velocity. Also calculate the specific energy at the inlet and at critical condition.

6. (a) Draw a neat sketch of the specific energy curve for an open channel with constant discharge. Define critical flow in an open channel and channel and derive general criterion for such a flow.

(b) A rectangular flume 2 m wide carries discharges at the rate of 2 m^3/s. The bed slope of the flume is 0.0004. At a section, the depth of flow is 1 m. Calculate the distance of the section downstream where the depth of flow is