Total number of printed pages - 02   **B.TECH**
                                                                       PCCH4201

3rd Semester Regular / Back Examination 2015-16
FLUID FLOW & FLOW MEASUREMENT
BRANCH : Chemical
Time : 3 Hours
Max Marks : 70
Question Code : T624

Answer Question No. 1 which is compulsory and any FIVE from the rest.
The figures in the right-hand margin indicate marks.
Assume suitable notations and any missing data wherever necessary.
Answer all parts of a question at a place.

1.   Answer the following questions :   **2 x 10**
  (a) Mention the principles followed while testing the dimensional consistency of an equation.
  (b) What are thixotropic and rheopecticfluids?
  (c) Distinguish between isotropic and anisotropic turbulence.
  (d) For the flow in the boundary layer, mention the relations between the boundary layer thickness (Z_x) and the distance from the leading edge of the plate (x) when the flow is laminar and turbulent.
  (e) In which case kinetic energy correction factor (α) is used? Mention its value for laminar and highly turbulent flow.
  (f) Write the Hagen-Poiseuille equation and mention its use.
  (g) Mention the values of $\frac{\bar{V}}{u_{max}}$ for different conditions of flow (or for different values of N_{Re}).
  (h) What are wall drag and form drag?
  (i) On what factors minimum fluidization velocity depends?
  (j) Why C_d of venturimeter is higher than C_d for orificemeter?

2.   The pressure difference (Δp) in a pipe of diameter (D) and   **10**
          length (l) due to turbulent flow depends on the velocity (V),
          viscosity (μ), density (ρ), and roughness (k). Using
          Buckingham's π-theorem, obtain an expression for Δp.

3. (a) A metal plate having dimensions 1.25 m x 1.25 m x 6 mm and   **05**
          weighing 90 N is placed midway in the 24 mm gap between the
          two vertical plane surfaces. The gap is filled with an oil of
          specific gravity 0.85 and dynamic viscosity 3.0 N.s/m^2.
          Determine the force required to lift the plate with a constant
          velocity of 0.15 m/s.

(b) A pipe of 450 mm in diameter is branched into two pipes of diameters 300 and 200 mm respectively. If the average velocity in 450mm diameter pipe is 3 m/s, find: **05**
  (i)   the discharge through 450mm diameter pipe and
  (ii) the velocity in 200 mm diameter pipe if the average velocity in 300 mm pipe is 2.5 m/s.

4. (a) Derive the point form of the Bernoulli equation without friction with a neat figure. **06**

(b) A venturimeter is installed in a pipeline carrying water and is 30 cm in diameter. The throat diameter is 12.5 cm. The pressure in pipeline is 140 kN/m^2 and the vacuum in the throat is 37.5 cm of mercury. 4 % of the differential head is lost between the gauges. Working from first principles find the flow rate in the pipeline in l/s assuming the venturimeter to be horizontal. **04**

5. For laminar flow of Newtonian fluids in pipes prove that: Momentum correction factor, $\beta = 4/3$. **10**

6. Utilizing the theory of friction in flow through beds of solids, derive the Ergun equation. **10**

7. (a) With a neat diagram, explain the construction and working of a centrifugal pump. **07**

(b) Explain in brief about pump priming. **03**

8. Write short notes on any **TWO**: **5 x 2**
  (a) Boundary layer separation and wake formation
  (b) Drag coefficient
  (c) Applications of fluidization
  (d) Net positive suction head