B. Tech.

(SEMESTER-V) THEORY EXAMINATION, 2012-13

FLUID MECHANICS

Time : 2 Hours  

[ Total Marks : 50 ]

Note : This question paper contains three sections, Section – A, Section – B and Section – C with weightage of 10, 15 and 25 marks respectively. Follow the instructions as given in each Section.

Section – A

1. This question contains five parts of two marks each. Attempt all parts of this question.  

   2 x 5 = 10

   (a) Define the term specific weight and specific gravity.

   (b) Write a small note on equation of motion for fluid flow.

   (c) What is Stokes law ?

   (d) Differentiate between Reynold’s number and Froude’s number.

   (e) Give two major differences between pipe flow and open channel flow.

Section – B

2. This question contains five parts of five marks each. Attempt any three parts.  

   5 x 3 = 15

   (a) Briefly describe the conditions of equilibrium of a floating body and submerged body.

   (b) A 30 cm diameter pipe carries water under a head of 15 m with a velocity of 4 m/s if the axis of the pipe turns through 45°, find the magnitude and direction of the resultant force at the bend.
(c) State and explain Buckingham-\(\pi\) theorem. Write conditions when Buckingham-\(\pi\) theorem is applied.

(d) A laminar flow is taking place in a pipe of diameter 200 mm. The maximum velocity is 1.5 m/sec. Find the mean velocity and the radius at which this occurs.

(e) Enumerate the losses in pipe flow. Explain any two losses in pipe flow system.

Section – C

This section contains five questions of five marks each. All questions are compulsory.

\[5 \times 5 = 25\]

3. Attempt any one part of the following:
   
   (a) Briefly explain the following terms:
       
       (i) Total acceleration
       (ii) Convective acceleration
       (iii) Local acceleration

   (b) A wooden block of width 2 m, depth 1.5 m and length 4 m floats horizontally in water. Find the volume of water displaced if the specific gravity of wooden block is 0.70.

4. Attempt any one part of the following:
   
   (a) What is the Euler’s equation of motion? How will you obtain Bernoulli equation from Euler’s equation?

   (b) Derive the expression for discharge through a triangular notch.

5. Attempt any one part of the following:
   
   (a) Explain the velocity profile of laminar flow between two parallel stationary plates.

   (b) Explain Eddy viscosity, mixing length concept and velocity distribution in turbulent flow.
6. Attempt any one part of the following:
   (a) Write short notes on following:
       (i) Total drag on a body
       (ii) Resultant force on a body
       (iii) Coefficient of drag and lift
   (b) Explain different types of hydraulic similarities that must exist between a prototype and its model.

7. Attempt any one part of the following:
   (a) A siphon of diameter 200 mm connects two reservoirs having a difference in elevation of 15 m. The total length of the siphon is 600 m and the summit is 4 m above the water level in the upper reservoir. If the separation takes place at 2.8 m of water absolute, find the maximum length of siphon from upper reservoir to the summit. Take $f = 0.004$ and atmospheric pressure = 10.3 m of water.
   
   (b) Explain the principle of water hammer in pipes. Derive the expression for water hammer in case of sudden closure of valve and pipe being rigid.