ANNA UNIVERSITY CHENNAI :: CHENNAI-600025

B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL/MAY 2013

CIVIL ENGINEERING BRANCH

Common to Agricultural and Irrigation Engineering

THIRD SEMESTER – (REGULATION 2008)

CE 9202 FLUID MECHANICS

Time : 3 hr | Assume any data if found necessary | Max Marks : 100

Answer All Questions

Part-A (10 x 2 = 20 Marks)

1. Write the units and dimensions for kinematic viscosity.
2. Distinguish between manometer and micro manometer.
3. Define streak line and stream line.
4. What is meant by control volume?
5. State Buckingham π- Theorem and write the advantage of using this method.
6. List out the model laws in the application of model studies.
7. State the use of Moody's diagram in pipe flow.
8. Differentiate between major and minor losses in flow through pipes.
9. What is meant by nominal thickness?
10. State the momentum integral equation.

Part-B (5 x 16 = 80 Marks)

(Question number 11 is compulsory)

11. Derive the expressions for displacement, momentum and energy thickness in boundary layer theory. Show the formation of boundary layer over a flat plate with the help of a sketch.

(16 marks)

12. (a) (i) An inclined circular gate 1 m in diameter with water on one side with its top edge located at a vertical distance of 1.5 m from the free surface is provided in a water control system. Calculate the resultant force acting on the gate and the location of centre of pressure.

(8 marks)

12. (a) (ii) A 'U' tube differential manometer connects two pressure pipes A and B. Pipe A contains oil of specific gravity 0.92 and pipe B also contains oil of specific gravity 0.92. The pipe A lies 60.96 cm below pipe B. The difference in mercury level in the 'U' tube is 30.48 cm with its upper level coincides with the same level of pipe A. Find the difference of pressure between the two pipes.

(8 marks)

(OR)

(P.T.O)

12. (b) (i) A piece of irregularly shaped metal weighs 300 N in air and it weighs 232.5 N in water when it is completely submerged. Calculate the volume of the metal. (4 marks)

12. (b) (ii) Derive an expression to find the total pressure and distance of centre of pressure from free surface of liquid for a vertical plane surface sub-merged in the liquid. (12 marks)

13. (a) The velocity components in a two dimensional flow field for an incompressible fluid are expressed as $u = \frac{y^3}{3} + 2x - x^2 y$; $v = xy^2 - 2y - \frac{x^3}{3}$ Show that these functions represent a possible case of irrotational flow and obtain an expression for stream function ψ and velocity potential function φ. (16 marks)

(OR)

13. (b) Derive the Euler's equation of motion for a fluid flow and also derive Bernoulli's equation along with its assumptions. (16 marks)

14. (a) The pressure drop Δp in a pipe of diameter D and length l depends on mass density ρ and viscosity μ of the flowing fluid, mean velocity of flow V and average height k of roughness projection on the pipe surface. Obtain a dimensionless expression for Δp. Hence show that $h_f = \frac{flV^2}{2gD}$ where h_f is the loss due to friction ($h_f = \frac{\Delta p}{\gamma}$), γ is the specific weight of the fluid and f is co-efficient of friction. (16 marks)

(OR)

14. (b) A spillway model is to be built to a geometrically similar scale of 1/50 across a flume of 60 cm width. The prototype is 15 m high and maximum head on it is expected to be 1.5 m. (i) What height of model and what head on the model should be used? (ii) If the flow over the model at a particular head is 12 litre per second, what flow per meter length of the prototype is expected? (iii) If the negative pressure in the model is 20 cm, what is the negative pressure in the prototype? (16 marks)

15. (a) Derive an expression for the loss of head occurring between parallel plates in a case of laminar flow and sketch the velocity and shear stress distribution diagram. (16 marks)

(OR)

15. (b) Write short notes on (i) losses in turbulent flow (ii) pipes in series and parallel (iii) equivalent pipe and (iv) loss due to an obstruction in pipe flow. (16 marks)