C 40937 (Pages : 2) Name.....

Reg. No.....

FOURTH SEMESTER B.TECH (ENGINEERING) DEGREE EXAMINATION, APRIL 2013

CE 09 403 / PTCE 09 402—FLUID MECHANICS

(2009 Scheme)

[Regular/Supplementary/Improvement]

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*

1. Define capillarity.
2. What is a stream function.
3. E explain the concept of compound pipe.
4. What are the assumptions in Bernoulli's Equation.
5. What is meant by Dynamic similarity.

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

6. Differentiate between local and convective acceleration.
7. What are the different forms of energy in a flowing fluid.
8. List out the minor energy losses in pipes.
9. What are the different methods for drawing flow net.
10. Explain Euler's equations of motion.
11. State Buckingham's π theorem.

(5 × 4 = 20 marks)

Part C

Answer **all** *questions.*
Each question carries 10 *marks.*

12. (A) The velocity components in a 2D flow field for an incompressible fluid are expressed as $u = \frac{y^3}{3} + 2x - x^2y$; $v = xy^2 - 2y - \frac{x^3}{3}$ show that these functions represents a possible case of an irrotational flow and obtain the expression for stream function and velocity potential function.

Or

Turn over

(B) (i) A U tube differential manometer connects two pipes A and B. Pipe A contains carbon tetra chloride having a specific gravity 1.594 under a pressure of 11.772 N/cm^2. and pipe B contain oil of specific gravity 0.8 under a pressure of 11.772 N/cm^2. The pipe A lies 2.5 m. above pipe B. Find the difference of pressure measured by mercury as fluid filling U tube.

(ii) Find the total pressure and position of centre of pressure on triangular plate of base 2 m. and height 3 m. which is immersed in water in such a way that the plane of the plate makes an angles of 60° with the free surface of the water. The base of the plate is parallel to the water surface and at depth of 2.5 cm. from water surface.

13. (A) (i) A pipe line carrying oil of specific gravity 0.8 changes in diameter from 300 mm. at a position A to 500 mm. diameter to a position B which is 5 m. at a higher level. If the pressures at A and B are 19.62 N/cm^2. and 14.91 N/cm^2. respectively, and the discharge is 150 litre/s, determine the loss of head and direction of flow.

(ii) What is the difference between pitot tube and prandtl tube.

Or

(B) A 45° reducing bend is connected in a pipe line, the diameters at the inlet and outlet of the bend being 600 mm. and 300 mm. respectively. Find the force exerted by water on the bend if the intensity of pressure at inlet to bend is 8.829 N/cm^2. and the rate of flow of water is 600 litres / s.

14. (A) Derive Hage Poisuillie equation for laminar flow.

Or

(B) A pipe line of 0.6 m. diameter is 1.5 km. long. To increase the discharge, another line of the same diameter is introduced parallel to the first in the second half of the length. Neglecting minor losses, find the increase in discharge if $4f = 0.04$. The head at the inlet is 300 mm.

15. (A) (ii) A flat plate 2 m. × 2 m. moves at 40 km/hr in stationery air of density 1.25 kg/m^3. If the coefficient of drag and lift are 0.2 and 0.8 respectively. Find the drag force, life force, the resultant force and the power required to keep the plate in motion.

(ii) In a 1 in 20 model of stilling basin, the height of the hydraulic jump in the model is observed to be 0.2 m. what is the height of the hydraulic jump in the prototype. If the energy dissipated in the model is 0.1 kW, What is the corresponding value in the prototype.

Or

(B) The pressure difference ΔP in pipe of Diameter D and length L due to turbulent flow depends on the velocity V, viscosity of fluid μ, density δ and roughness K. Derive the expression for ΔP using Buckingham's π theorem.

(4 × 10 = 40 marks)