C 27998 (Pages : 2) Name.....

Reg. No.....

FOURTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION JULY 2012

CE 04 404—FLUID MECHANICS

Time : Three Hours Maximum : 100 Marks

Part A

1. (a) Define Capillary. Derive the expression for Capillary rise and Capillary fall.

   (b) Briefly explain the Lagrangian method and Eulerian method.

   (c) Define vortex flow. Briefly explain free and forced vortex flow with examples.

   (d) Find the velocity of flow of an oil through a pipe, when the difference of mercury level in a differential U tube manometer connected to the two tapping's of the Pitot tube is 100 mm. Take co-efficient of Pitot tube as 0.98 and specific gravity of oil as 0.8

   (e) An oil of specific gravity 0.7 is flowing through a pipe of diameter 300 mm a the rate of 500 lit/s. Find the head loss due to friction and power required to maintain the flow for a length of 1000 m. Take $\upsilon = 0.29$ stokes.

   (f) Derive the expression for loss of head due to sudden enlargement.

   (g) Write the advantages of dimensional and model analysis.

   (h) Define the following dimensional no : Reynold's Number, Froude's Number, Weber's Number, Euler's Number and Mach's Number.

(8 × 5 = 40 marks)

Part B

2. (a) The stream function for a two dimensional flow is given by $\psi = 2xy$, calculate the velocity at the point (2, 3). Find the velocity potential function φ.

Or

   (b) The velocity vector in a fluid is given $V = 4x^3 i - 10x^2 yj + 2tk$. Find the velocity and acceleration of a fluid particle at (2, 1, 3) at time $t = 1$.

3. (a) State and derive the Bernoulli's equation.

Or

A Pitot tube is inserted in a pipe of 300 mm diameter. The static pressure in pipe is 100 mm of ercury (vacuum). The stagnation pressure at the centre of the pipe, recorded by the Pitot is 0.981 N/cm^2. Calculate the rate of flow of water through pipe, if the mean velocity of 0.85 times the central velocity. Take $C_v = 0.98$

Turn over

4. (a) Explain the detail the various losses of energy in pipes.

Or

(b) A horizontal pipe of diameter 500 mm is suddenly contracted to a diameter of 250 mm. The pressure intensity in the large and smaller pipe is given as 13.734 N/cm^2 and 11.772 N/cm^2 respectively. Find the loss of head due to contraction if $C_e = 0.62$. Also determine the rate of flow of water.

5. (a) (i) State Buckingham's π –theorem. (3 marks)

(ii) The efficiency η of a fan depend on density, dynamic viscosity μ of the fluid, angular velocity ω, diameter D of the rotor and the discharge Q. Express η in terms of dimensionless parameters.

(12 marks)

Or

(b) (i) Write a short notes on Reynold's model law. (5 marks)

(ii) A ship 300 m long moves in sea water, whose density is 1030 kg/m^3, A 1 : 100 model of this ship is to be tested in a wind tunnel. The velocity of air in the wind tunnel around the model is 30 m/s and the resistance of the model is 60 N. Determine the velocity of ship in sea water and also the resistance of the ship in sea water. The density of air is given as 1.24 kg/m^3. Take the kinematic viscosity of sea water and air as 0.012 stokes and 0.018 stokes respectively.

(10 marks)

[4 × 15 = 60 marks]