Reg No._____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, JANUARY 2017

Course Code**: CE203**

Course Name**: FLUID MECHANICS – I (CE)**

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two Questions.

1. a) A triangular plate of 1 metre base and 1.5 metre altitude is immersed in water. The plane of the plate is inclined at 30^0 with free water surface and the base is parallel to and at a depth of 2 metres from water surface. Find the total pressure on the plate and the position of centre of pressure. (10)
   b) Explain the terms circulation and vorticity. (5)

2. a) Show that a cylindrical buoy 1.25m diameter and 3.25m high weighing 11127 N will not float vertically in sea water weighing 10055 N/m^3. Find the tension necessary in a vertical chain attached to the centre of the base of the buoy that will just keep the cylinder vertical. (13)
   b) Differentiate between the Eulerian and Lagrangian methods of representing fluid flow. (2)

3. a) The velocity vector in an incompressible flow is given by $V= (6xt + yz^2)i + (3t + xy^2)j + (xy – 2xyz – 6tz)k$ (i) Verify whether continuity equation is satisfied. (ii) Determine the acceleration and velocity at point A (1,1,1) at t =1. (12)
   b) Differentiate betweensimple manometer and differential manometer (3)

PART B

Answer any two Questions

4. The diameter of a pipe bend is 30 cm at inlet and 15 cm at outlet and the flow is turned through 120^0 in a vertical plane. The axis at inlet is horizontal and the centre of the outlet section is 1.5 m below the centre of the inlet section. Total volume of water in the bend is 0.9 m^3. Neglecting friction, calculate the magnitude and direction of the force exerted by the bend on the water flowing at 250 litres/s and when the inlet pressure is 0.15 N/mm^2. (15)

5. a) What are the forces and assumptions considered in the derivation of Euler's equation of motion? (5)
   b) The flow in a 2 m wide rectangular channel is measured by a rectangular weir 1m long and 0.6 m high. Find the discharge in the channel when the head over the weir is 0.3 m. Take C_d as 0.62. Consider end contractions and velocity of approach.(10)

6. a)A circular tank of diameter 3 m contains water up to a height of 4 m. The tank is provided with an orifice of diameter 0.4 m at the bottom. Find the time taken by water, (i) to fall from 4 m to 2 m and (ii) for completely emptying the tank. Take C_d = 0.6. (10)
   b) Define energy correction factor and momentum correction factor. (5)

PART C

Answer any two Questions

7. a) Derive the Hagen –Poiseulle equation for laminar flow in circular pipes.(10)
   b) A piping system consists of three pipes arranged in series; the lengths of the pipes are 1200 m, 750 m and 600 m and diameters 750 mm, 600 mm and 450 mm respectively. (i) Transform the system to an equivalent 450 mm diameter pipe, and (ii) Determine an equivalent diameter for the pipe, 2550 m long. (10)

8. a) The velocity distribution in the boundary layer is given by
   $u/U = 2(y/\delta) - (y/\delta)^2$, δ being boundary layer thickness. Find (i) the displacement thickness, (ii) the momentum thickness and (iii) the energy thickness. (10)
   b) What are the major and minor losses in a pipeline? (5)
   c) Define momentum thickness and energy thickness. (5)

9. a) What is the difference between friction drag and pressure drag? (5)
   b) Calculate the friction drag on a plate 0.15 m wide and 0.45 m long placed longitudinally in a stream of oil flowing with a free stream velocity of 6 m/s. Also find the thickness of the boundary layer and shear stress at the trailing edge. Specific gravity of oil is 0.925 and its kinematic viscosity is 0.9×10^{-4} m^2/s. (10)
   c) Define Hydraulic Grade Line and Total Energy Line. (5)

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