Code No: RT21016 **R13** SET - 1

II B. Tech I Semester Regular Examinations, Dec - 2015
FLUID MECHANICS
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) What is viscosity? Why the viscosity of liquids usually decreases as the temperature increases?
   b) What is centre of pressure? Why its position is always different from the position of center of gravity in case of submerged surfaces?
   c) Write the Bernoulli's equation for steady flow and state the necessary conditions that need to be satisfied.
   d) What is Reynolds number? Explain the affect of various parameters on Reynolds number.
   e) Name and explain four important characteristics of turbulent flow.
   f) Define coefficient of discharge for a venturimeter. Why it is always less than unity?

PART –B

2. a) Define Pascal's law.
   b) A differential manometer is connected to two pipes whose centres are at 3 m difference in height. Higher level pipe is carrying liquid of specific gravity of 0.9 at a pressure of 1.8 bar and another pipe is carrying liquid at specific gravity of 1.5 at a pressure of 1 bar. The centre of pipe carrying low pressure liquid is 2 m above the higher level of the mercury in the manometer. Find out the difference in mercury level in the manometer in cm.

3. A right angled triangular plate is held in water in the vertical plane. Find out the total pressure acting on the plate and the position of its centre of pressure from both axis X and Y.

4. Discuss the application of Bernoulli's equation for the following:
   (i) Inclined Manometer (ii) Orifice Meter

5. a) Write the Prandtl's boundary layer equations and state their significance.
   b) How the separation of the boundary layer is controlled.

6. Three pipes of 40 cm in diameter, 300 m long, 20 cm in diameter, 400 m long and 30 cm in diameter, 200 m long are connected in series and the ends are connected to two tanks whose water level difference is 20 m. find the discharge through the compound pipe, (i) considering only frictional losses (ii) frictional and all other minor losses. Assume friction factor as 0.005

7. What is venture meter? Derive an expression for the volume flow rate in terms of coefficient of discharge and pressure difference.
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PART –A

1. a) What is surface tension? How temperatures influence surface tension?
   b) What is stream line? Write the differential equation for it in Cartesian coordinate system.
   c) Write the Euler's equation of motion along a streamline. Show the forces acting on the fluid element along the streamline.
   d) Write four forms of velocity distributions for laminar boundary layer development.
   e) Show the Moody's chart schematically and explain its significance.
   f) Briefly explain the process of calibration of an orificemeter.

PART –B

2. a) Define Hydrostatic law.
   b) In a hydraulic jack, the diameter of small and large pistons is 2 cm and 10 cm respectively. If the force applied on small piston is 1000 N, find the load lifted by the large piston when (i) Both pistons are at same level (ii) Smaller piston is 50 cm above the large piston. The specific gravity of oil is 0.8.

3. A Circular plate 4 m in diameter is placed in such a way that it top vertex is at 2 m below free water surface and bottom vertex is 5 m below the free water surface. Find out the total pressure acting on the plate.

4. a) Derive the Euler's equations of motion for three dimensional steady state incompressible non viscous flow.
   b) Write the Navier-Stokes equation and explain the terms.

5. What is Magnus effect? Derive an expression for the stream function for flow past a cylinder with circulation.

6. A pipe line 30 cm in diameter 1500 m long is used to connect two tanks and has a slope of 1 in 100. The water level in the first tank is 10 m above inlet of the pipe and water level in the second tank is 2 m above the outlet of the pipe. Considering only frictional losses, find the flow rate through the pipe. Also draw TEL and HGL lines. Take friction factor as 0.005

7. a) Give the classification for notches and weirs.
   b) Derive an expression for discharge over a broad crested weir.
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Code No: RT21016 **R13** SET - 3

II B. Tech I Semester Regular Examinations, Dec - 2015
FLUID MECHANICS
(Civil Engineering)

Time: 3 hours Max. Marks: 70

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2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) What is inverted manometer? Where it is used?
   b) What is stream function? Write an equation for streamline in terms of stream function.
   c) Write the Navier-Stokes equation in Cartesian coordinates along x-direction. State the Unknowns of the equation.
   d) Define thickness of the boundary layer for flow over a flat plate. Write an expression for it according to Blausius.
   e) With the help of schematic diagram, show the flow pattern through abrupt but finite enlargement.
   f) Briefly explain the working principle of Pitot static tube.

PART –B

2. a) Define specific gravity & Viscosity of fluid.
   b) A U-tube mercury manometer is used to measure the pressure of oil flowing through a pipe whose specific gravity is 0.85. The centre of the pipe is 15 cm below the level of mercury. The mercury level difference in the manometer is 25 cm, determine the absolute pressure of the oil flowing through the pipe. Atmospheric pressure = 750 mm of Hg.

3. A triangular plate with base 2 m and height of 4 m is immersed in water and the plane of the plate makes an angle 30^0 with the free surface of water. The base is parallel to water surface and 2 m below the free water surface. Find out the total pressure acting on the plate and the centre of pressure from free surface of water.

4. A Pipe carrying air (ρ = 1.2 Kg/m^3) has cross-sectional area of 1 m^2 has been provided a bend whose cross-sectional area is gradually reduced from 1 m^2 to 0.5 m^2 area. The bend angle is 45^0 to the horizontal in anticlockwise direction. The air enters the pipe with a velocity of 10 m/s and 30 KPa pressure. Find the magnitude and direction of the force required to hold the pipe in position.

5. a) Compare the velocity profiles in a pipe for (i) laminar and (ii) turbulent flow.
   b) Derive an expression for the lift force for flow past a rotating cylinder.

6. a) Write Darcy's equation and explain its significance.
   b) A pipe system consists of three pipes connected in series i) 300 m long, 150 mm in diameter ii) 150 m long, 100 mm in diameter and iii) 250 m long, 200 mm in diameter. Find the Equivalent length of a 125 mm diameter pipe. Assume friction factor as 0.02 and coefficient of contraction as 0.6

7. Water flows through a 300 mm X 150 mm venturimeter at the rate of 0.037 m^3/s and the differential gauge is deflected 1 m. specific gravity of the gauge liquid is 1.25. Find the coefficient of discharge of the meter.

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Code No: RT21016 **R13** SET - 4

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(Civil Engineering)

Time: 3 hours Max. Marks: 70

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2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) What is inclined tube manometer? For what purpose it is used?
b) Show that equipotential lines and stream lines are orthogonal to each other except at Stagnation point.
c) Describe the losses in pipe bends.
d) Define favorable and adverse pressure gradients. How they influence the boundary layer Separation.
e) State the four principles for flow through branched pipes.
f) Give the classification of notches.

PART –B

2. a) Define Gauge & Vacuum Pressure.
b) Describe a micro manometer & derive an expression for the same.

3. In an incompressible flow field, the velocity vector is given by **V** = $(6xt+yz^2)$ **i** + $(3t+xy^2)$ **j** + (xy-2xyz – 6tz) **k**.Verify whether the flow exists or not? If so, then find the acceleration vector at a point P (1,2,3) at t = 2.

4. A 45^0 reducing bend is connected to a pipe line whose inlet and outlet diameters are 60 cm and 30 cm respectively. The water flow through the pipe is 0.6 m^3/s. The pressure of the water at the inlet of the bend is 90 KN/m^2. Find the total force exerted on the bend. The pipe line rests on the ground.

5. a) Represent the development of boundary layer on a flat plate.
b) Water at 15^0c flows over a flat plate at a speed of 1.2 m/s. The plate is 0.3 m long and 2 m wide. The boundary layer on each surface of the plate is laminar. Assume the velocity profile to be a linear expression with $\frac{\delta}{x} = \frac{3.46}{\sqrt{Re_x}}$. Find the drag force on the plate. Take ν for water as 1.1 X $10^{-6}\, m^2/s$ & $\rho = 1000\ kg/m^3$.

6. The total head at inlet to a pipe network system is 20m of water more than that at its outlet. Compare the rate of discharge of water, if the network system consists of (i) three pipes each 700 m long but of diameters 450 mm, 300 mm and 600 mm respectively in the order from inlet to outlet. (ii) the same three pipes in parallel. Assume friction factor for all the pipes to be 0.01 and the coefficient of contraction to be 0.6

7. Two orifices are fitted on the same side of the tank which is filled with water to a height of H. one orifice is located at a depth Z from the free surface of water and the other is located at the height Z from the bottom of the tank. Assuming same coefficient of velocity for both orifices, show that the jet will strike the ground at same horizontal distance from the tank. If H=5 m and Z=2 m, find the horizontal distance with velocity coefficient is 0.96.
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