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

II B. Tech I Semester Supplementary Examinations, June - 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

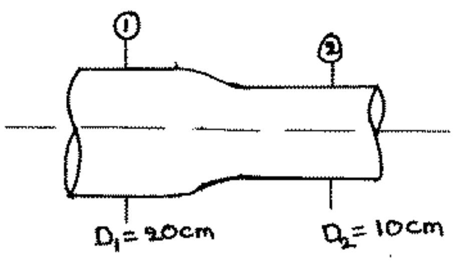
1. a) What are the properties of ideal fluid?
b) Define Specific volume and Specific Gravity.
c) Differentiate between uniform and non uniform flow
d) What is momentum equation?
e) What are the factors influencing the frictional loss in pipe flow ?
f) What is the principle involved in venturimeter (4M+4M+4M+3M+3M+4M)

PART-B

2. a) What are the different types fluids? Explain each type.
b) State Pascal's law and give some examples where this principle is applied (8M+ 8M)

3. a) explain the terms total pressure and center of pressure
b) what are the methods of describing fluid flow (8M+ 8M)

4. a) Derive Bernoulli's theorem and state its limitations.
b)Gasoline which has a vapour pressure of 5.5×10^4Pa(abs) and density ρ=680kg/m^3flows through a construction in a pipe where the diameter is reduced from 20cm to 10cm. The pressure in the 20 cm pipe just upstream of the construction is 50kPa. If the atmospheric pressure is 75cm of mercury, calculate the maximum discharge that can be passed through this construction without cavitation occurring. (4M+12M)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5. a) Define boundary layer and give its significance.
   b) For the following velocity distribution verifies whether the essential and desirable boundary conditions to be the velocity distributions in a laminar boundary layer are satisfied:
   $\frac{u}{U} = sin\left[\frac{\pi y}{2\delta}\right]$
   $\frac{u}{U} = 1 + \eta - 2\,\eta^2$ Where $\eta = y/\,\delta$ (4M+12M)

6. a) What is the physical significance of Reynold's number?
   b) A lubricating oil of relative density 0.92 and dynamic viscosity 0.085 Pa. s is to be pumped at a rate of 40L/s with energy gradient in laminar flow not exceeding 0.04. Determine the least diameter of the pipe to satisfy the above requirement. (4M+12M)

7. a)Differentiate between Venturi meter and Orifice meter

   b) A 4cm diameter orifice in the vertical side of a tank discharges water. The water surface in the tank is at a constant level 0f 2.0 m above the centre of the orifice. If the head loss in the orifice is 0.20m and the coefficient of contraction can be assumed to be 0.63, estimate i) the values of the coefficient of velocity and coefficient of discharge ii) the discharge through the orifice and iii)the location of the point of impact of the jet on a horizontal plane located 0.5m below the centre of the orifice. (4M+12M)

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PART-A

1. a) What are the properties of real fluid?
   b) Define Surface tension and Capillarity.
   c) Differentiate between steady and unsteady flow
   d) What is Hagen poiseuille's formula?
   e) What is the principle involved in pitot tube (4M+4M+4M+4M+6M)

PART-B

2. a) One liter of crude oil weighs 9.6 N. Calculate its Specific weight, density and specific volume.
   b) Differentiate between simple and differential manometers (8M+ 8M)

3. a) Show that the centre of pressure of any lamina immersed under liquid is always below its centroid
   b) Define the equation of continuity. Obtain an expression for continuity equation for a 3 dimensional flow (8M+ 8M)
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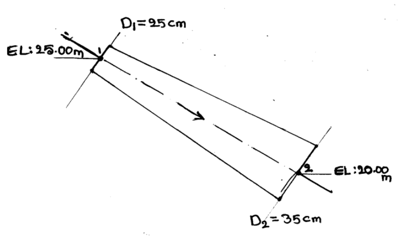
4. Derive Euler's equation of motion for flow along a stream line. What are the assumptions involved.
   b) A tapering pipe has a diameter of 25cm at point 1(elevation 25.00m) and a diameter of 35cm at point 2(elevation 20.00m) as shown in fig. If the pressure at point 1 is 120kPa, calculate the pressure at point 2 for a discharge of 0.20m^3/s of water. The kinetic energy correction factors for sections 1 and 2 are 1.1 and 1.5 respectively. The loss of head through the pipe can be assumed to be $1.2(v_1-v_2)^2/2g$. The flow is from section 1 to section 2.
   (6M+10M)

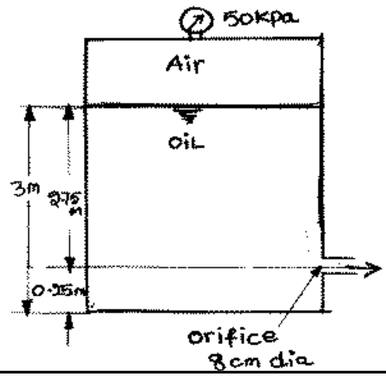


5. if the velocity distribution in a laminar boundary layer on a flat plate is
   $\frac{u}{U} = a + b\eta + c\eta^2 + d\eta^3$ where $\eta = y/\delta$, determine the coefficients a, b, c and d. (16M)

6. a) Write down four examples of laminar flow.

   b) An oil of relative density 0.92 and dynamic viscosity 0.082 Pa.s flows in an 80mm diameter pipe. In a discharge of 20m the flow has a head loss of 2m. Calculate the i)mean velocity ii) discharge iii) velocity and shear stress at a radial distance of 38mm from the pipe axis and iv)boundary shear stress. (4M+12M)

7. A closed cylindrical tank as shown in fig is 3.5m high and contains an oil of relative density 0.85 to a height of 3.0 m above the bottom. The space above the oil surface contains air under a pressure of 50kPa. If an 8cm diameter orifice is provided on the side of the tank with its centre 25cm above the bottom, estimate the weight of fluid discharged in one minute. (take C_d=0.60)
   (16M)



Code No: RT21016 **R13** SET - 3

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PART-A

1. a) Define kinematic viscosity. What is the relation between kinematic and dynamic viscosity.
   b) Discuss the thermodynamic properties of fluids
   c) Differentiate between laminar and turbulent flow
   d) What is the expression for head loss due to friction in Darcy formula?
   e) What is the principle involved in orificemeter (6M+4M+4M+4M+4M)

PART-B

2. a) Explain all three Simple manometers with neat sketches.
   b) State the advantages of mechanical pressure gauges over manometers? (8M+ 8M)

3. a) Show that the centre of pressure of any lamina immersed under liquid is always below its centroid
   b) Define the equation of continuity. Obtain an expression for continuity equation for a 2 dimensional flow (8M+ 8M)

4. State Bernoulli theorem for steady flow of an incompressible fluid. Derive an expression for Bernoulli equation and state the assumptions made. (16M)

5. Calculate the friction drag on a flat plate 15cm wide and 45cm long placed longitudinally in a stream of oil of relative density 0.925 and kinematic viscosity 0.9stoke,flowing with a free stream velocity of 6.0 m/s. Also, find the thickness of the boundary layer and shear stress at the trailing edge. (16M)
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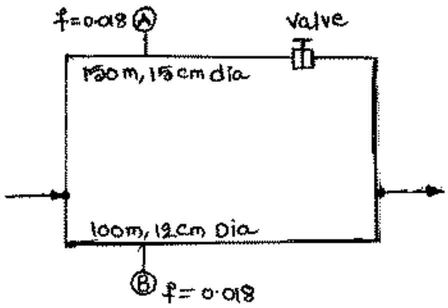
6. **a)** Differentiate between laminar and turbulent flow.
   b)Two pipes A and B are connected in parallel between two points. Pipe A is 150m long and has a diameter of 15cm. Pipe B is 100m long and has a diameter of 12cm. Both pipes have the same friction factor of 0.018. A partially closed valve in pipe A causes discharge in the two pipes to be the same as shown in fig. Estimate the value of the valve coefficient. All other minor losses can be neglected. (4M+12M)



7. A 10cm diameter pipe has a nozzle at its end. If the velocity in the pipe is 2.5m/s and pressure 50kpa, calculate the velocity, the diameter of the jet and the head loss in the jet. The jet is discharged into atmosphere and the coefficient of velocity in the jet can be taken as 0.98. (16M)

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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) Define kinematic viscosity. What is the relation between kinematic and dynamic viscosity.
b) Define Newtonian law of Viscosity
c) State momentum equation?
d) What do you understand by the terms i) major energy losses, ii) minor energy losses
e) what is the principle involved in venturimeter (6M+4M+4M+4M+4M)

PART-B

2. a) Explain how the vaccum pressure can be measured with the help of U-tube manometer?
b) A U-tube differential manometer is connected two pressure pipes A and B. Pipe A contains Carbon tetrachloride 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 pressure 11.72 N/ Cm^2 . The pipe A lies 2.5 m above pipe B. Find the difference of pressure measured by mercury as a fluid filling U-tube. (6M+10M)

3. a) Show that the centre of pressure of any lamina immersed under liquid is always below its centroid
b) Define the equation of continuity. Obtain an expression for continuity equation for a 3 dimensional flow (8M+8M)

4. Derive Bernoulli's equation for the flow of an incompressible frictionless fluid from consideration of momentum. (16M)

5. A smooth flat plate 2.0m wide and 2.5m long is towed in oil (RD=0.8) at a velocity of 1.5m/s along its length. Find the thickness of the boundary layer and shear stress at a) the centre b) the trailing edge of the plate. Also find the power required for the towing the plate [$\nu_{oil}=10^{-4} m^2/s$] (16M)
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6. In a fully rough turbulent flow in a 15cm diameter pipe the centre line velocity is 2.50m/s and the local velocity at mid-radius is 2.28m/s. Find the discharge and the height of the roughness projections. (16M)

7. A nozzle attached to the end of a 10cm diameter pipe as shown in fig. has 3cm diameter at the other end. If the nozzle issues out a jet of water at 25m/s into atmosphere, calculate the pressure at the base of the nozzle. The coefficient of velocity and contraction for the nozzle can be taken as 0.96 and 0.80respectively. (16M)