**Course Code:** 20CE0109 **R20**

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR**
**(AUTONOMOUS)**
Siddharth Nagar, Narayanavanam Road – 517583

**QUESTION BANK (DESCRIPTIVE)**

**Subject with Code:FLUIDMECHANICS(20CE0109)** **Course & Branch**: B.Tech &CE

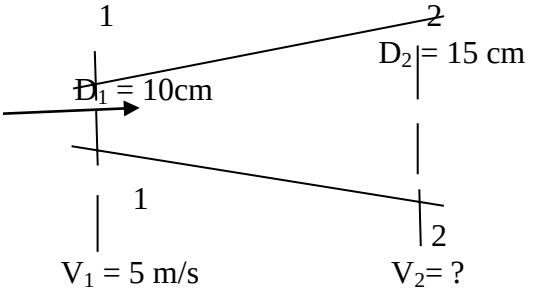
**Year & Sem: II B.Tech & I Sem** **Regulation:R20**

## UNIT –I
## FLUID PROPERTIES AND FLUID STASTICS

| | | | |
|---|---|---|---|
| 1 | Define the physical properties of fluids and Write its units? | [L2][CO1] | [12M] |
| 2 | a) Define viscosity and its S.I units? | [L2][CO1] | [6M] |
| | b) Two horizontal plates are placed 1.25cm apart, the space between them filled with oil of viscosity 14 Poise. Calculate the Shear Stress in oil if upper plate is moved with velocity of 2.5 m/sec. | [L3][CO1] | [6M] |
| 3 | The space b/w two square parallel plates filled with oil. Each side of the plate is 60 cm. The thickness of oil film is 12.5. The upper plate which moves at 2.5m/sec requires a force 98.1 N to maintain the speed. Determine the<br>i) Dynamic viscosity of oil in poise.<br>ii) Kinetic viscosity of the oil in stokes, If the specific gravity of the oil 0.95. | [L3][CO1] | [12M] |
| 4 | a) Explain the phenomenon of capillarity. Obtain an expression for capillary rise of a liquid. | [L2][CO1] | [6M] |
| | b)Calculate the capillary rise in a glass tube of 2.5mm diameter when immersedvertically in a) water & b) mercury .Take surface tension is 0.0725 $N/m^2$ for water And 0.52 $N/m^2$ for mercury in contact with air. The specific gravity for mercury is<br>Given as 13.6 & angle of contact is $130^0$ | [L3][CO1] | [6M] |
| 5 | Explain the following:<br>i) Surface Tension ii) Vapour Pressure iii) Compressibility | [L2][CO1] | [12M] |
| 6 | a) State Pascal's law and Derive pressure variation in liquid at rest? | [L2][CO1] | [6M] |
| | b)Define the following terms :<br>i).Atmospheric Pressure ii).Absolute Pressure iii).Gauge pressure iv).Vacuum pressure | [L2][CO1] | [6M] |
| 7 | a) Explain briefly the working principle of piezometer and U-Tube manometer with a neat sketch. | [L2][CO1] | [6M] |
| | b) Explain briefly the working principle Bourdon's pressure gauge with a neat sketch. | [L2][CO1] | [6M] |
| 8 | a) Derive the Expression for Total Pressure of vertical plane surface. | [L2][CO1] | [6M] |
| | b) Derive the Equation for Center of Pressure of vertical plane surface. | [L2][CO1] | [6M] |
| 9 | A rectangular plane surface is 2m wide and 3m deep it lies in vertical plane in water. Determine the total pressure and position of centre of pressure on the plane surface when its appear edge is horizontal and: a).Coincides with water surface b).2.5 m below the free surface. | [L3][CO1] | [12M] |
| 10 | Find the volume of water displayed and center of buoyancy for a wooden block of width 2.5 m and depth 1.5 m. when it floats horizontally in water. The density of wooden block is 650 $kg/m^3$ and its length is 6m. | [L3][CO1] | [12M] |

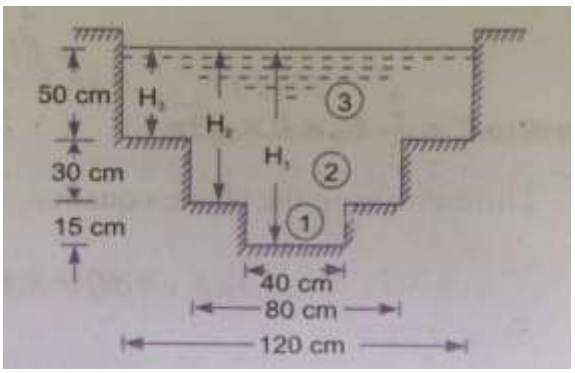
**Course Code:** 20CE0109 **R20**

## UNIT –II
## FLUID KINEMATICS

| | | | |
|---|---|---|---|
| 1 | Explain in detail about different types of flow? | [L1][CO2] | [12M] |
| 2 | a) Define<br>i) Stream line<br>ii) Streak line<br>iii) Path line<br>iv) Stream Tube | [L2][CO2] | [8M] |
| | b) Define Local Acceleration and Velocity Potential function with formulae. | [L2][CO2] | [4M] |
| 3 | Derive Continuity Equation in 3-Dimensional flow? | [L3][CO2] | [12M] |
| 4 | Explain in detail about Velocity Potential Function and write its properties. | [L1][CO2] | [12M] |
| 5 | Explain about the stream function with definition in Two-dimensional flow and polar co-ordinates. Also write its properties. | [L1][CO2] | [12M] |
| 6 | A 30 cm dia. pipe conveying water branches into two pipes of dia. 20 cm and 15 cm respectively. If the average velocity in the 30 cm dia. pipe is 2.5 m/s. Find the discharge in this pipe. Also determine the velocity in 15 cm pipe. If the average velocity in 20 cm diameter pipe is 2 m/s. | [L3][CO2] | [12M] |
| 7 | The Velocity Potential function ( ø ) is given by an expression $\emptyset = \frac{-xy^3}{3} - x^2 + \frac{x^3y}{3} + y^2$<br>i. Find the velocity components in x and y direction.<br>ii. Show that ø remains represents the possible case of flow. | [L3][CO2] | [12M] |
| 8 | The velocity vector in a fluid flow is given as $V = 4x^3i - 10x^2yj + 2$ . Find the velocity and acceleration of fluid particles at ( 2 , 1 , 3 ) at time t = 1 . | [L3][CO2] | [12M] |
| 9 | The Stream function for a Two-dimensional flow is given by Q = 2xy. Calculate the velocity at the point P (2, 3 ). Find the velocity potential ø. | [L3][CO2] | [12M] |
| 10 | a) Explain the continuity equation for One-dimensional flow in terms of Rate of flow. | [L3][CO2] | [6M] |
| | b) The dia. of pipe at the section 1 & 2 are 10 cm and 15 cm respectively. Find the discharge through the pipe. If the velocity of water flowing through the pipe at section 1 is 5 m/s. Determine also the velocity at the section 2.<br>  <br> | [L3][CO2] | [6M] |

**Course Code:** 20CE0109 **R20**

## UNIT –III
## FLUID DYNAMICS AND FLOW MEASUREMENT

| | | | |
|---|---|---|---|
| 1 | Derive the Euler's equation of motion along a stream line with assumptions. | [L3][CO3] | [12M] |
| 2 | Derive the Bernoulli's energy equation with assumptions. | [L3][CO3] | [12M] |
| 3 | a) Give a short notes on Energy correction factor . | [L2][CO3] | [6M] |
| | b) Define momentum correction factor. | [L2][CO3] | [6M] |
| 4 | A vertical wall of 8m in height. A jet of water is carrying out from a nozzle with a velocity of 20 m/s. The nozzle is situated at a distance of 20m from the vertical wall. Find the angle of projection of the nozzle to the horizontal so that the jet of water just clears the top of wall. | [L3][CO3] | [12M] |
| 5 | a) Briefly explain about Forced vortex flow and free vortex flow. | [L3][CO3] | [4M] |
| | b) The water is flowing through a pipe having diameter of 20 cm and 10 cm at section & 2 respectively. The rate of flow through pipe is 35 lit/sec. The section 1 is 6m above the datum and section 2 is 4m above the datum. If the pressure at the section 1 is 39.24 N/cm$^2$. Find the intensity of pressure at the section 2. | [L3][CO3] | [8M] |
| 6 | Derive the Expression for velocity measurement by Pitot tube and pitot static tube. | [L3][CO4] | [12M] |
| 7 | a) Derive an expression for the discharge over a rectangular notch. | [L3][CO4] | [6M] |
| | b).A rectangular notch 2m wide as a constant head of 500mm. Find the discharge over the notch ,if co-efficient of discharge for the notch is 0.62 and g = 9.81.? | [L2][CO4] | [6M] |
| 8 | a) Water flows over a rectangular weir 1m wide and at a depth of 150mm and afterwards passes through a triangular right-angled weir. Taking $C_d$ for the rectangular and triangular weir as 0.62 and 0.59 respectively. Find the depth over the triangular weir. | [L2][CO4] | [6M] |
| | b) Water flows through right angled weir first and then over a rectangular weir of width 1m. The discharge coefficient of the triangular and rectangular weirs are 0.6 and 0.7. If the depth if water over triangular weir is 360mm. find the depth of water of rectangular weir. | [L3][CO4] | [6M] |
| 9 | A Cipolletti weir of crest length 60 cm discharges water. The head of water over the weir is 360 mm. Find the discharge over the weir if the channel is 80 cm wide and 50 cm deep. $C_d$=0.60. | [L3][CO4] | [12M] |
| 10 | Fig below shows a stepped notch. Find the discharge through the notch if $C_d$ for all sections =0.62.   | [L3][CO4] | [12M] |

**Course Code:** 20CE0109 **R20**

## UNIT –IV
## ANALYSIS OF PIPE FLOW

| | | | |
|---|---|---|---|
| 1 | Find the head lost due to friction in a pipe of dia 300mm & length 50m through which water is flowing at a velocity of 3 m/s using :<br>**a)** Darcy's formula<br>**b)** Chezy'sformula for which C = 60. Take kinematic viscosity of for water =0.01 stoke? | [L2][CO5]<br>[L2][CO5] | [6M]<br>[6M] |
| 2 | An oil of specific gravity 0.7 flowing through a pipe of 300mm at the rate of 50lit/s. find the head lost due to friction and power required to maintain the flow for a length of 1000m & Take kinematic viscosity 0.29 stoke? | [L3][CO5] | [12M] |
| 3 | A horizontal pipe line 40m long is connected to the water tank at one end and discharges freely into the atmosphere at the other end. For the first 25 m of its length from the tank pipe is 150mm and its dia is suddenly enlarged to 300mm. the height of water level in the tank is 8m above the center of pipe considering all losses of head which cover occur. Determine the rate of flow. Take f = 0.01, for both sections of the pipe? | [L3][CO5] | [12M] |
| 4 | The difference in water surface levels in two tanks, which are connected by the pipes of the lengths 300m, 170m and 210m and of Ø 300mm,200mm and 400mm respectively. Determine the rate of flow of water if coefficient of friction is 0.005, 0.0052 & 0.0048 respectively. Considering i) Minor losses also ii) Neglecting minor losses. | [L3][CO5] | [12M] |
| 5 | A main pipe divides into two parallel pipes which again forms one pipe as shown in figure. Above the length & and dia for the first parallel pipe are 2000m & 1.0m respectively. While the length & dia of $2^{nd}$ parallel pipe are 2000m & 0.8m. Find the rate of flow in each parallel pipe if total flow in the main is 3.0 $m^3/s$. the coefficient of friction for each parallel pipe is same & equal to 0.005? | [L][CO5] | [12M] |
| 6 | Three pipes of lengths 800m, 500m & 400m & of dia 500mm, 400mm & 300mm respectively are connected in series. These pipes are replaced by a single pipe of length 1700m. Find the dia of the single pipe? | [L3][CO5] | [12M] |
| 7 | A syphon is Ø 200mm connects two reservoirs having a difference in elevation of 20m. The length of the syphon is 500m and the summit is 3m above the water level in the upper reservoir. The length of the pipe from upper reservoir to the summit is 100m. Determine the discharge through the syphon & also pressure at the summit. Neglect minor losses. The coefficient of the friction f = 0.005? | [L3][CO5] | [12M] |
| 8 | The rate of flow water through a horizontal pipe of 0. 25m $m^3/s$. The dia of the pipe which is 200mm is suddenly enlarged to 400mm. the pressure intensity in the smaller pipe is 11.772 $N/cm^2$. Determine i) Loss of head due to sudden enlargement ii) Pressure intensity in the large pipe iii) power lost due to enlargement? | [L3][CO5] | [12M] |
| 9 | Briefly explain about Hardy cross method? | [L2][CO5] | [12M] |
| 10 | A crude oil of kinematic viscosity 0.4 stoke is flowing through a pipe of dia 300mm at the rate of 300 lit/s. find the head lost due to friction for a length of 50m of the pipe? | [L3][CO5] | [12M] |

**Course Code:** 20CE0109 **R20**

## UNIT –V
## LAMINAR AND TURBULANT FLOW

| | | | |
|---|---|---|---|
| 1 | What is dimensionless number? Explain different types of numbers | [L2][CO6] | [12M] |
| 2 | Explain in detail about Reynolds experiment | [L2][CO6] | [12M] |
| 3 | Derive the laminar flow through circular pipes | [L3][CO6] | [12M] |
| 4 | Derive the Hagen poiseuille equation | [L3][CO6] | [12M] |
| 5 | Calculate i) pressure gradient along flow ii) average velocity iii) discharge for an oil of viscosity 0.02 $Ns/m^2$ flowing between two stationary parallel plates 1m wide maintained 10mm apart. The velocity between plates is 2m/s | [L2][CO6] | [12M] |
| 6 | a) Define turbulent flow. What are the causes of turbulent flow | [L3][CO6] | [6M] |
| | b) Oil of absolute viscosity 1.5 poise and relative density 0.85 flow through a 30cm diameter pipe .if the head loss in 3000m length of pipe is 20m,estimate<br>i).The shear stress at the pipe wall<br>ii).The shear stress at a radial distance 10cm from the pipe axis. | [L3][CO6] | [6M] |
| 7 | Derive an expression for velocity distribution in turbulent flow | [L3][CO6] | [12M] |
| 8 | A Pipe line carrying water has average height of irregularities projecting from the surface of the boundary of the pipe as 0.15mm. What type of boundary is it? the shear stress developed is 4.9 $N/M^2$ . The kinematic viscosity of water is 0.01 Stokes. | [L3][CO6] | [12M] |
| 9 | a)Derive the expression for resistance of smooth pipes | [L3][CO6] | [6M] |
| | b) Derive the expression for resistance of rough pipes | [L3][CO6] | [6M] |
| 10 | Water is flowing through a rough pipe of 500mm diameter and length 4000m at the rate of 0.5 $m^3/s$. find the power required to maintain this flow. Take average height of roughness as k= 0.4mm | [L3][CO6] | [12M] |

**PREPARED BY:**

**Ms. A. JYOSHNA**
**Asst Professor, CE**