**Course Code:** 19CE0109 **R19**

## SIDDARTHA INSTITUTE OF SCIENCE AND TECHNOLOGY::PUTTUR
## (AUTONOMOUS)
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**QUESTION BANK (DESCRIPTIVE)**

**Subject with Code:** Fluid Mechanics (19CE0109) **Course & Branch**: B.Tech - CE

**Year & Sem:** II-B.Tech & II-Sem **Regulation:** R19

# UNIT –I
## FLUID PROPERTIES AND FLUID STASTICS

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| **1** | Define the physical properties of fluids and its values And write standard values and its units | [L2][CO1] | **[12M]** |
| **2** | Define viscosity, kinematic viscosity, newtons law of viscosity? And its S.I units? | [L2][CO1] | **[12M]** |
| **3** | List the classification of measurement of pressures | [L1][CO1] | **[12M]** |
| **4** | 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 kinetic viscosity of the oil. If the specific gravity of the oil 0.95 and dynamic viscosity of oil. | [L3][CO1] | **[12M]** |
| **5** | A simple U-tube manometer containing mercury in which a fluid of sp. Gravity 0.8 and having vacuum pressure. The other end of the manometer is open to atmosphere. Find the vacuum pressure in pipe. If the mercury level in the limb is 40 cm and height of fluid in the left from the center of pipe is 15 cm below | [L3][CO1] | **[12M]** |
| **6** | A Differential manometer is connected at the two points A and B of two pipes. The pipe A contains a liquid of specific gravity of 1.5 while pipe B contains a liquid of specific gravity of 0.9. The pressure at A & B are 1kgf/cm$^2$ and 1.8 kgf/cm$^2$ respectively. Find the difference in mercury level in the differential manometer. | [L2][CO1] | **[12M]** |
| **7** | 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:<br>(a) Coincides with water surface<br>(b) 2.5 m below the free surface. | [L2][CO1] | **[12M]** |
| **8** | Find the volume of water displayed and center of buoyance 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. | [L2][CO1] | **[12M]** |
| **9** | A circular plate 3mm dia is immersed in water in such a way that its greater and least depth below the surface or 4m and 1.5 m respectively. Determine the total pressure and center of pressure | [L3][CO1] | **[12M]** |

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| **10** | Define about total pressure and center of pressure | [L2][CO1] | **[12M]** |

# UNIT –II
## FLUID KINEMATICS

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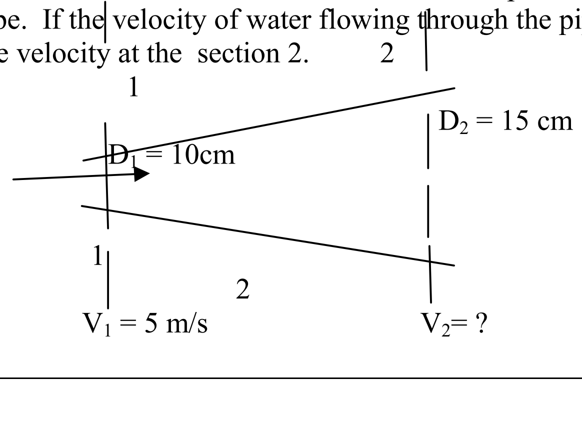
| **1** | Explain in detail about different types of flow | [L1][CO2] | **[12M]** |
| **2** | a) Define<br>i) Stream line<br>ii) Streak line<br>iii) Path line<br>iv) Stream Tube | [L2][CO2] | **[8M]** |
| | b) Define Local Acceleration and Velocity Potential function with formulae. | [L2][CO2] | **[4M]** |
| **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][CO3] | **[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. | [L2][CO3] | **[12M]** |
| **7** | The Velocity Potential function ( Ø ) is given by an expression<br>$\emptyset = \frac{-xy^3}{3} - x^2 + \frac{x^3y}{3} + y^2$<br>i. Find the velocity components in x and y direction.<br>ii. Show that Øremains represents the possible case of flow. | [L3][CO2] | **[12M]** |
| **8** | The velocity vector in a fluid flow is given as $V = 4x^2i - 10x^2y + 2tK$ . Find the velocity and acceleration of fluid particles at ( 2 , 1 , 3 ) at time t = 1 . | [L2][CO3] | **[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 potentialØ **.** | [L3][CO3] | **[12M]** |
| **10** | a) Explain the continuity equation for One-dimensional flow in terms of Rate of flow.<br>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][CO3] | **[12M]** |

# UNIT –III
## FLUID DYNAMICS AND FLOW MEASUREMENT

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| **1** | The water is flowing through a pipe having diameter of 20 cm and 10 cm at section 1 & 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. | [L2][CO3] | **[12M]** |
| **2** | . A pipe line carrying oil of specific gravity of 0.87, changes in diameter from 200m diameter at a position A to 500mm diameter at a position B which is 4m at a higher level. If the pressure at A&B are 9.81 N/cm$^2$ and 5.886 N/cm$^2$ respectively and the discharge is 200 lit/ sec. Determine the loss of head and the direction of flow. | [L2][CO3] | **[12M]** |
| **3** | 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]** |
| **4** | A horizontal venturimeter with inlet and throat diameter of 30 cm and 15 cm respectively is used to measure the flow of water. The readings of differential manometer connected to the inlet and the throat is 20 cm of mercury. Determine the rate of flow. Take the $C_d$ = 0.98. | [L3][CO4] | **[10M]** |
| **5** | Water flows through a circular orifice of 25 mm diameter provided in the side of a tank discharging water under a constant head of 800 mm. The co-ordinates at a certain point of the jet are 300 mm from the vena contracta horizontally and 32 mm vertically below the centre line of the orifice. The water id collected in a tank of size 600mm X 600mm and collected water rises by 33 mm in 10 sec. Find $C_C$ , $C_V$, $C_d$ . | [L3][CO4] | **[12M]** |
| **6** | A rectangular orifice 1.2m wide is discharging water from a large rectangular tank. The water level from the top and bottom of orifice are 2.5m and 3m respectively. Find the discharge through the orifice, if the difference of water levels on both sides of orifice is 0.8m. Take $C_d$ = 0.61. | [L2][CO4] | **[12M]** |
| **7** | Derive the expression of discharge over a Triangular notch or Weir ( V- NOTCH ). | [L2][CO4] | **[12M]** |
| **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.<br>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. | [L2][CO4] | **[12M]** |
| **9** | a) 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.<br>b) An ogee weir 5m long has a head of 40 cm of water. If the $C_d$=0.6, find the discharge over the weir. | [L3][CO4] | **[12M]** |

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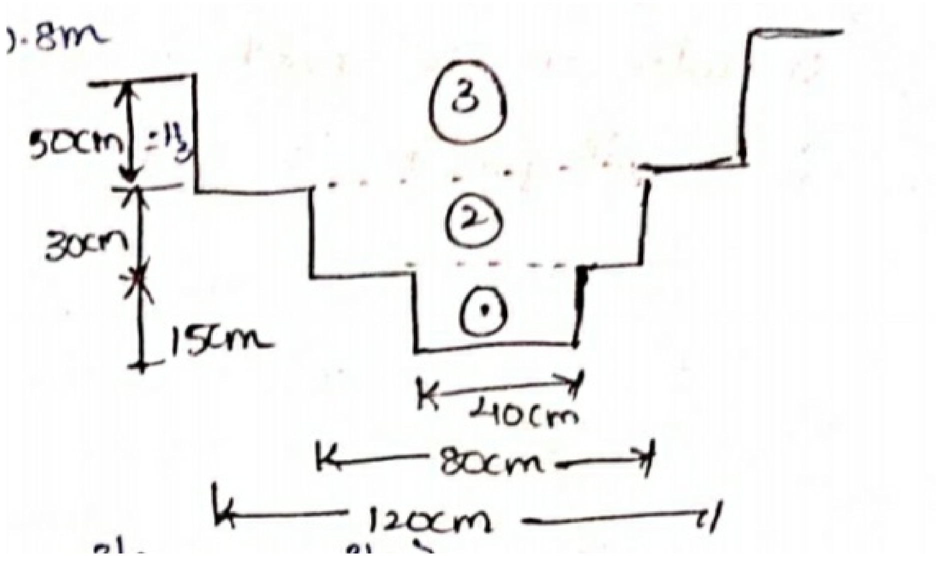
| **10** | Fig below shows a stepped notch. Find the discharge through the notch if $C_d$ for all sections =0.62.<br> | [L2][CO4] | **[12M]** |

# UNIT –IV
## ANALYSIS OF PIPE FLOW

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| **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? | [L1][CO5]<br>[L2][CO5] | **[6M]**<br>**[6M]** |
| **2** | An oil of specific gravity is 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 foe a length of 1000m | [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? | [L2][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. | [L2][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 | [L2][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 | [L2][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]** |

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| **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 | [L2][CO5] | **[12M]** |

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# UNIT –V
## LAMINAR AND TUBULANT FLOW

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| 1 | What is dimensionless number. Explain different types of numbers | [L2][CO5] | **[10M]** |
| **2.** | Explain in detail about reylonds experiment | [L2][CO5] | **[10M]** |
| | Derive the equation for i) velocity distribution and ii) ratio of maximum velocity to average velocity | [L2][CO5] | **[10M]** |
| **4** | 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 | [L3][CO5] | **[10M]** |
| **5.** | Derive the Hagen poiseuille equation | [L2][CO5] | **[10M]** |
| **6.** | a) Define turbulent flow. What are the causes of turbulent flow<br>b) derive the equation for pressure drop in laminar flow | [L2][CO5] | **[10M]** |
| **7.** | Derive an experession for velocity distributionin turbulent flow | [L2][CO5] | **[10M]** |
| **8.** | Derive the expression for resistance of smooth pipes | [L2][CO5] | **[10M]** |
| **9.** | Derive the expression for resistance of rough pipes | [L2][CO5] | **[10M]** |
| **10.** | Water is flowing through a rough pipe of 500 dia 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] | **[10M]** |

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