INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

CIVIL ENGINEERING

QUESTION BANK

Course Name	:	**Fluid Mechanics**
Course Code	**:**	**A30101**
Class	:	II-I- B. Tech
Branch	:	CIVIL ENGINEERING
Year	:	2016– 2017
Course Coordinator	:	Mr. G. Anand Reddy, Assistant Professor, Civil Engineering
Course Faculty	:	Mr. G. Anand Reddy, Assistant Professor, Civil Engineering

OBJECTIVES

The objectives of the course are to enable the student;

I. To understand the basic principles of fluid mechanics
II. To identify various types of flows
III. To understand boundary layer concepts and flow through pipes
IV. To evaluate the performance of hydraulic turbines
V. To understand the functioning and characteristic curves of pumps

1. Group - A (Short Answer Questions)

S. No	Question	Blooms Taxonomy Level	Program Outcome
	UNIT-I **DIMENSIONS AND UNITS**		
1	Define density, weight density.	Understanding	1
2	Define specific volume	Understanding	1
3	Define Newton's laws of viscosity.	Understanding	1
4	Define surface tension.	Understanding	1
5	Define compressibility.	Understanding	1
6	Define viscosity.	Understanding	1
7	Define vapour pressure.	Understanding	1
8	Define atmospheric gauge and vacuum pressure.	Understanding & remembering	1
9	Define compressible and incompressible fluid.	Understanding	1
10	Define and classify the manometers.	Understanding	1
11	Define specific gravity.	Understanding	1
12	Define Monometer	Understanding	1
13	Define Cohesion	Understanding	1
14	Define adhesion	Understanding	1
15	How are Fluids Classified?	Understanding	2

16	What are the units of Surface tension?	Understanding	2
17	Give the relation for pressure inside a water droplet	Understanding	2
18	How does the vapour pressure vary with the temperature?	Understanding	2
19	What is Newtonian Fluid?	Understanding	2
20	What is Non-Newtonian Fluid?	Understanding	2
UNIT-II FLUID KINEMATICS			
1	Define path line, stream line, stream tube and streak line.	Understanding	9
2	Define steady and unsteady flows.	Understanding	9
3	Define rotational and ir-rotational flows.	Understanding & remembering	9
4	Define uniform and non uniform flows.	Understanding & remembering	9
5	Define and state the applications of momentum equation.	Understanding & remembering	9
6	Define laminar and turbulent flows.	Understanding & remembering	9
7	Define compressible and incompressible flows.	Understanding & remembering	9
8	Define the equation of continuity.	Understanding & remembering	9
9	Define the terms velocity potential and stream functions.	Understanding & remembering	9
10	Define the terms vertex, free vortex flows and forced vortex flows.	Understanding & remembering	9
11	Mention one difference between streamline and path line	Understanding	9
12	What are streak lines?	Understanding	9
13	What is one dimensional flow with example?	Understanding	9
14	What are two dimensional flows with example?	Understanding	9
15	What are three dimensional flows with example?	Understanding	9
16	What is vorticity?	Understanding	9
17	What is a system?	Understanding	9
18	What is system boundary?	Understanding	9
19	State the Newton's Second law of motion.	Understanding& remembering	9
20	State Reynolds's transport theorem	Understanding& remembering	9
UNIT-III FLUID DYNAMICS			
1	Name the different forces present in a fluid flow.	understanding	10
2	What is Euler's equation of motion.	understanding	10
3	What is venturimeter.	understanding	10
4	Define an orifice meter.	understanding	10
5	What is a pitot tube.	Understanding	10
6	Define moment of momentum equation.	understanding	10
7	Define continuity and Bernoulli's equation.	Remembering	10
8	What is a free jet of a liquid.	Understanding & evaluate	10

9	What are the different forms of energy in a flowing fliud.	Understanding & evaluate	2
10	Explain different types of pitot tubes.	Understanding & Evaluate	2
11	Give Energy Equation of an ideal Flow along a Streamline	Understanding & Evaluate	2
12	Give the mechanical Energy equation	Understanding & Evaluate	2
13	Give the Bernoulli's equation with head loss	Understanding & Evaluate	2
14	Give the Bernoulli's equation in Irrotational flow	Understanding & Evaluate	2
15	Provide Navier's equation	Understanding & Evaluate	2
16	Provide momentum equations	Understanding & Evaluate	2
17	Give the classsificatio of orifices.	understanding	2
18	What are notches?	understanding	2
19	What are the types of notches?	understanding	2
20	What is a weir and what are its types?	understanding	2
UNIT-IV **BOUNDARY LAYER THEORY**			
1	What do you understand by the terms boundary layer theory.	understanding	l
2	What is meant by boundary layer.	understanding	l
3	What do you mean by boundary layer separation.	remembering	l
4	Define displacement thickness.	remembering	l
5	What are the different methods of preventing the separating of boundary layers.	understanding	l
6	What is the effect of pressure gradient on boundary layer separation.	remembering	l
7	Define laminar boundary layer and turbulent boundary layer.	understanding	l
8	Define laminar sub layer and boundary layer thickness.	Understanding & remembering	l
9	Define lift.	Understanding & remembering	l
10	Define magnus effect.	Understanding	l
11	Write the prandtl contribution in boundary layer theory.	Understanding & remembering	l
12	Draw Boundary layer and Free Stream for Flow Over a flat plate	Understanding & remembering	l
13	Write two applications of boundary layer theory	Understanding & remembering	l
14	State boundary layer co-ordinates	Understanding & remembering	l

15	State Vonkarmen momentumintegral trasition equation	Understanding & remembering	l
16	Explain Boundary layer Transition.	Understanding & remembering	l
17	Explain Boundary layer Separation.	Understanding & remembering	l
18	Explain Boundary layer control.	Understanding & remembering	l
19	Define the term drag.	Understanding	l
20	Define the term momentum thickness.	Understanding	l
UNIT-V CLOSED CONDUIT FLOW			
1	Define Reynold's experiment.	Understanding	6
2	What are the characteristics of laminar flows.	Remembering	6
3	What are the characteristics of turbulent flows.	Remembering & Understanding	6
4	What is the flow between parallel lines.	Remembering & Understanding	6
5	What are the laws of fluid friction.	Understanding	6
6	Define Darcy's equation.	Understanding	6
7	What are minor losses in pipes in series.	Understanding & remembering	6
8	What are minor losses in pipes in parallel.	Understanding	6
9	What is energy line.	Remembering & Understanding	6
10	What is hydraulic gradient line.	Understanding	6
11	Define flow through long tubes.	Remembering & Understanding	6
12	Define flow through inclined tubes.	Remembering & Understanding	6
13	What is hydraulic gradient line?	Remembering & Understanding	6
14	Draw the figure for laminar flow.	Remembering & Understanding	6
15	Draw the figure for turbulent flow.	Remembering & Understanding	6
16	What is Moody's chart?	Remembering & Understanding	6
17	Draw the figure for fully developed turbulent pipe flow	Remembering & Understanding	6
18	State the characteristics of turbulent flow.	Remembering & Understanding	6
19	Compare velocity profiles in laminar and turbulent flows.	Remembering & Understanding	6
20	What are the characteristics of turbulent flow.	Remembering & Understanding	6

2. Group - II (Long Answer Questions)

S. No	Question	Blooms Taxonomy Level	Program Outcome
	UNIT-I **DIMENSIONS AND UNITS**		
1	State Newton's law viscosity and explain how viscosity varies with temperature for liquids and gases	Understanding & remembering	9
2	Derive an expression for surface tension on a liquid jet.	Analyze	9
3	Derive an expression for surface tension on a liquid droplet.	Analyze	9
4	How do you measure the pressure by using manometers and mechanical gauges?	Analyze & Apply	9
5	Prove that volumetric strain of a cylindrical rod which is subjected to an axial tensile load is equal to the strain in the length minus twice the strain if diameter.	Analyze & Apply	9
6	Why does the viscosity of a gas increases with the increases in temperature while that of a liquid decreases with increase in temperature?	Analyze & Apply	9
7	Calculate density, specific weight and weight of 1 liter of petrol of specific gravity 0.7	Analyze & Apply	9
8	State Newton's law viscosity and explain how viscosity varies with temperature for liquids and gases	Analyze & Apply	9
9	Explain the phenomenon of capillarity .Obtain an expression for capillarity rise of a fluid.	Analyze & Apply	9
10	Develop the expression for the relation between gauge pressure P inside a droplet of liquid and the surface tension.	Analyze & Apply	9
11	State Newton's third law of motion and summarize how viscosity of liquids differ with temperature for particles in liquid state and gaseous state.	Analyze & Apply	9
12	What is surface tension? Derive the expression for surface tension on a liquid jet.	Analyze & Apply	9
13	Derive the expression for surface tension on a liquid Droplet. What is surface tension?	Analyze & Apply	9
14	Write the procedure for determining/measuring pressures by monometers and mechanical gauges.	Analyze & Apply	9
15	Obtain the relation with parameter like volumetric strain of cylindrical rod, its strain and diameter strain in case of a cylindrical rod subjected to axial tensile load.	Analyze & Apply	9
16	Explain the phenomenon of temperature changes in viscosities of a liquid	Analyze & Apply	9
17	Explain the phenomenon of temperature changes in viscosities of a gas	Analyze & Apply	9
18	Derive the expression for capillary rise of a fluid.	Analyze & Apply	9
19	Obtain the expression for surface tension and guage pressure for a liquid droplet.	Analyze & Apply	9

S. No	Question	Blooms Taxonomy Level	Program Outcome
	UNIT-II **FLUID KINEMATICS**		
1	Sketch the flow pattern of an ideal fluid past a cylinder with circulation.	Understanding	12
2	Derive the condition for ir-rotational flow. Prove that for potential flow, both the stream function and velocity potential function must satisfy Laplace equation.	Understanding	12
3	Derive an expression for total pressure on a plane surface submerged in a liquid of specific weight with an inclination an angle θ.	Understanding	12
4	Obtain an expression for continuity equation for a 3-D Flow.	Analyze & Apply	12
5	Bring out the mathematical and physical distinction between rotational and ir-rotational flows.	Analyze & Apply	12
6	Describe the use and limitations of flow nets	Analyze & Apply	12
7	Obtain an expression for continuity equation for a 1-D Flow	Analyze & Apply	12
8	Derive path line, stream line, and streak line.	Analyze & Apply	12
9	State the properties of stream function and prove each one of them.	Analyze & Apply	12
10	What is a stream tube and explain are its characteristics.	Analyze & Apply	12
11	Draw the flow pattern of a non- ideal fluid past a cylinder with rotation.	Analyze & Apply	12
12	What is ir-rotational Flow ? Show that in a laplace equation is satisfied in potential flows-stream function and velocity potential function.	Analyze & Apply	12
13	With an inclination an angle θ and a plane surface submerged in a liquid of specific weight derive for total pressure.	Analyze & Apply	12
14	What is continuity equation? Obtain the continuity equations for multi/ three dimensional flow.	Analyze & Apply	12
15	What are the characteristics of Rotational and Ir-rotational Flows. Also distinguish with mathematical expressions.	Analyze & Apply	12
16	What is a flow net and what are the advantages and dis-advantages of flow nets.	Analyze & Apply	12
17	Explain continuity equation and derive the continuity equation for one dimensional flow.	Analyze & Apply	12
18	Define Uniform and non- uniform, Compressible and non- compressible , ideal and non ideal fluids.	Analyze & Apply	12
19	What is a streamline and a streak line. By justifying any one of the stream functions state its properties.	Analyze & Apply	12
20	Define system, surroundings, system boundaries and their broad classification with explanation. Draw charts	Analyze & Apply	12

S. No	Question	Blooms Taxonomy Level	Program Outcome
	UNIT-III **FLUID DYNAMICS**		
1	Derive an expression for displacement thickness due to formation of boundary layer	Understanding	9
2	How do you distinguish sharp crested weir from a broad crested weir? Derive the expression for discharge over a sharp crested rectangular weir?	Analyze & Apply	9
3	For the Euler's equation of motion which forces are taken into consideration.	Analyze & Apply	9
4	What is Euler's equation? How will you obtain Bernoulli's equation from it.	Analyze & Apply	9
5	Discuss the relative merits and demerits of venturimeter with respect to orifice meter.	Analyze & Apply	9
6	What is the difference between the pitot tube and pitot static tube.	Analyze & Apply	9
7	What is the difference between the momentum equation and impulse momentum equation.	Analyze & Apply	9
8	Derive Euler's equation of motion along a stream line for an ideal fluid and clearly the assumptions.	Analyze & Apply	9
9	Why is divergence more gradual than convergence in a venturimeter.	Analyze & Apply	9
10	Explain the principle of venturimeter with a neat sketch.derive the expression rate of flow of fluid through it.	Analyze & Apply	9
11	What is a boundary layer and derive displacement thickness due to BL.	Analyze & Apply	9
12	Derive the expression for discharge over a broad crested weir. Differentiate broad and sharp crested weir.	Analyze & Apply	9
13	Explain the Euler's equation of motion considering the forces	Analyze & Apply	9
14	Derive Bernoulli's equation from Euler's equation. What is the importance of Euler's equation state it.	Analyze & Apply	9
15	State the advantages and disadvantages between venturimeter and orifice meter.	Analyze & Apply	9
16	State the advantages OR disadvantages of pitot static tube over pitot tube.	Analyze & Apply	9
17	Explain momentum equation and impulse momentum equation and its differences.	Analyze & Apply	9
18	What are the assumptions of Euler's equation of motion along a stream line. Explain Newtonian and non- Newtonian fluids.	Analyze & Apply	9
19	Expalin Divergence and convergence in a venturimeter briefly.	Analyze & Apply	9
20	Explain the flow in triangular, rectangular and trapezoidal notches.	Analyze & Apply	9
	UNIT-IV **BOUNDARY LAYER THEORY**		
1	Derive an expression for displacement thickness due to formation of boundary layer.	Analyze & Apply	10

S. No	Question	Blooms Taxonomy Level	Program Outcome
2	Explain with sketches the three methods of boundary layer control.	Analyze & Apply	10
3	Derive an expression for momentum thickness of boundary layer.	Analyze & Apply	10
4	Explain magnus effect and theory of lift for airfoils.	Analyze & Apply	10
5	Derive the expression for the energy and momentum correction factor	Analyze & Apply	10
6	What are the boundary conditions that must be satisfied by a given velocity profile in laminar boundary layer flows.	Understanding	10
7	Obtain Von karman momentum integral equation.	Understanding	10
8	Explain boundary layer separation? Mention few methods to prevent or delay the separation of boundary layer?	Evaluate	10
9	Derive Prandtl's boundary layer equation.	Evaluate	10
10	Derive expressions for boundary layer thickness ,boundary shear stress and friction drag in a turbulent boundary layer	Analyze & Apply	10
11	Explain the formation of boundary layer and displacement thickness.	Analyze & Apply	10
12	What is boundary layer control and explain with diagrams.	Analyze & Apply	10
13	What is momentum thickness? Explain its characteristics.	Analyze & Apply	10
14	With the help of different theories explain magnus effect.	Analyze & Apply	10
15	Explain Boundary layer in separation, Transition and control.	Analyze & Apply	10
16	What are the boundary conditions that must be satisfied by a given velocity profile in Turbulent boundary layer flows.	Analyze & Apply	10
17	Derive expressions for boundary layer thickness ,boundary shear stress and friction drag in a laminar boundary layer	Analyze & Apply	10
18	Write about separation of boundary layer and how to prevent it.	Analyze & Apply	10
19	Explain the flow around submerged objects.	Analyze & Apply	10
20	Explain the characteristics of a boundary layer of a thin flat plate.	Analyze & Apply	10
	UNIT-V **CLOSED CONDUIT FLOW**		
1	Obtain the condition for maximum efficiency in transmission of power through pipeline	Analyze & Apply	15
2	Derive formulas for hydraulic gradient and total energy lines	Analyze & Apply	15
3	Derive the equation for head loss in pipes due to friction Darcy-Weisbach equation.	Analyze & Apply	15
4	What are the minor losses in pipes? Give the appropriate formulae to calculate the losses.	Analyze & Apply	15
5	What do you understand by turbulent flow? What factor decides the type of flow in pipes?	Apply	15
6	Derive an expression for the loss of head due to friction in pipes.	Analyze &	15

S. No	Question	Blooms Taxonomy Level	Program Outcome
		Apply	
7	Derive Darcy-Weisbach equation.	Analyze & Apply	15
8	What is the velocity defect? Derive an expression for velocity defect in pipes?	Analyze & Apply	15
9	Why are the pipes connected in parallel.	Analyze & Apply	15
10	Explain what do you understand by hydraulic grade line and total energy line. Discuss its practical significance in analysis of fluid flow problems.	Analyze & Apply	15
11	Explain the phenomenon of transmission of power through pipeline and the condition for maximum efficiency.	Analyze & Apply	15
12	Obtain the expressions for Hydraulic gradient line and total energy lines.	analyze & Apply	15
13	Derive the equations for head loss in pipes using Darcy Weishbach's equation.	analyze & Apply	15
14	Explain minor and major losses in pipes. Obtain general formulae for loss determination.	analyze & Apply	15
15	List out the important factors determining the type of flow in pipes.	analyze & Apply	15
16	Explain the phenomenon of velocity defect in pipes.	analyze & Apply	15
17	What is the importance, advantages and limitations of pipes connected in parallel and series.	analyze & Apply	15
18	Elaborate the practical significance in analysis of fluid flow problems. Distinguish Hydraulic gradient line and total energy line.	analyze & Apply	15
19	Discuss the variation of friction factor with Reynolds's number.	analyze & Apply	15
20	Explain the characteristics of laminar and turbulent flow and flow between parallel plates with neat sketches.	analyze & Apply	15

3. Group - III (Analytical Questions)

S.No	QUESTIONS	Blooms Taxonomy Level	Program Outcome
	UNIT-I **DIMENSIONS AND UNITS**		
1	A plate of a certain oil weighs 40 KN. Calculate the specific weight, mass density and specific gravity of this oil.	Apply & Evaluate	1
2	A plate 0.0254 mm distant from a fixed plate, moves at 61cm/sec and requires a force of 0.2 kgf/m^2 to maintain this speed. Determine the dynamic viscosity of the fluid between the plates.	Apply & Evaluate	1
3	A rectangular plate of size 25 cm by 50 cm and weighing 25 kgf slides down a 30^0 inclined surface at a uniform velocity of 2m/sec . If the uniform 2mm gap between the plate and the inclined surface is filled with oil determine the viscosity of the oil.	Apply & Evaluate	1
4	Calculate the capillary effect in mm in a glass tube 3mm in diameter when immersed in (a) water (b) mercury. Both the liquids are at 20^0c and the values	Apply & Evaluate	1

S.No	QUESTIONS	Blooms Taxonomy Level	Program Outcome
	of the surface tensions for water and mercury at 20^0c in contact with air are respectively 0.0736 N/m and 0.51 N/m. Contact angle for water = 0^0 and for mercury = 130^0.		
5	What is the pressure with in a droplet of water 0.05 mm in diameter at 20^0c, if the pressure outside the droplet is standard atmospheric pressure of 1.03 kg(f) / cm^2. Given σ = 0.0075 kg(f)/m for water at 20^0 C.	Apply & Evaluate	1
6	If the equation of a velocity profile over a plate is $V=2y^{2/3}$ in which V is the velocity in m/sec at a distance of y meters above the plate. Determine the shear stress at y=0 and y=0.075m given H = 0.835N.S/m^2.	Apply & Evaluate	1
7	Convert a pressure head of 100m of water to a) Kerosene of specific gravity 0.81 b) Carbon tetra chloride of specific gravity 1.6	Apply & evaluate	1
8	A trapezoidal channel 2m wide at the bottom and 1m deep has side slopes 1:1. Determine :the totoal pressure and the centre pressure on the vertical gate closing the channel when it is full of water.	Apply & evaluate	1
9	A flat plate weighing 0.45KN has a surface area of $0.1m^2$. It slides down an inclined plane at 30^0 to the horizontal at a constant speed of 3m/s. if the inclined plane is lubricated with an oil of viscosity 0.1Ns/m^2. Find the thickness of the oil film.	Apply & evaluate	1
10	A rectangular plane surface 3m wide and 4m deep lies in water in such a way that its plane making an angle of 30^0 with the surface of water.detrmine the total pressure force and position of centre of pressure , when upper edge is 2m below the free surface.	Apply & evaluate	1
	UNIT-II **FLUID KINEMATICS**		
1	An open circular cylinder of 15cm diameter and 100cm long contains water upto a height of 70cm.find the speed at which the cylinder is to be rotated about its vertical axis so that the axial depth becomes zero.	Apply & Evaluate	9
2	A vessel cylindrical in shape and closed at the bottom conrtains water upto a height of 80cm.the diameter of the vessel is 20cm and length of vessl is 120cm. the vessel is rotated at a speed of 400r.p.m about its vertical axis.find the height of paraboloid formed.	Apply & Evaluate	9
3	In a free cylindrical vortex flowsd,at a point in the fluid at a radius of 200mm and a height of 100mm.The velocity and pressures are 10m/s and 117.72KN/m^2.find the pressure at a radius of 400mm and at a height of 200mm. the fluid is air having density equal to 1.24kg/m^3.	Apply & Evaluate	9
4	A uniform flow with a velocity of 20m/s is flowing over a source of strength $10m^2$/s.the uniform flow and source flow are in the same plane	Apply & Evaluate	9
5	A vessel cylindrical in shape and closed at the bottom and the top contains water at a height of 700mm. The dia of the vessel is 200mm and length of the vessel is 1.1m. Find the speed of rotation of the vessel if the axial depth of the water is Zero.	Apply & Evaluate	9
6	An open circular cylinder of 20cm dia and 100cm long contains water upto a height of 80cm. It is rotated about its vertical axis. Find the speed of rotation when there is no water spills and axial depth is Zero.	Apply & Evaluate	9
7	In a free cylindrical vortex flow of water at a point at a radius of 150mm the velocity and pressure are 5m/s and 14.715n/cm^2. Find the pressure at a radius of 300mm.	Apply & Evaluate	9

S.No	QUESTIONS	Blooms Taxonomy Level	Program Outcome
8	If the cylindrical vessel of dia 15cm and length 100cm contains water at a height of 80cm is rotated at 950r.p.m. About its vertical axis, find the Area uncovered at the base of the tank.	Apply & Evaluate	9
9	A rectangular pontoon of size 6m length , 3m width and 1.5 m height has a length of 0.95m in sea water of specific weight 10055 n/m^3 . Determine its metacentric height assuming it to have a uniform composition.	Apply & Evaluate	9
10	A triangular gate which has a base of 1.5 m and an altitude of 2 m lies in a vertical plane. The vertex of the gate is 1 m below the surface in a tank which contains oil of specific gravity 0.8. Find the force exerted by the oil on the gate and the position of the centre of pressure	Apply & Evaluate	9
	UNIT-III FLUID DYNAMICS		
1	When 2500 liters of water flows per minute through a 0.3m diameter pipe which later reduces to a 0.15 diameter pipe, calculate the velocities of flow in the two pipes.	Apply & Evaluate	10
2	A pipe of dia 400mm carries water at a velocity of 25m/s. The pressures at a point are given as 29.43n/cm^2 and 22.563n/cm^2 while the datum head at A and B are 28m and 30m. Find the loss of head between A and B.	Apply & Evaluate	10
3	A horizontal venturimeter with inlet and throat and diameters 30cm and 15cm is used to measure the flow of water. The reading of differential manometer connected to the inlet and the throat is 20cm of mercury. Determine the rate of flow. Take $C_d = 0.98$.	Apply & Evaluate	10
4	Two velocity components are given in the following case, find the third component such that they satisfy the continuity equation. $U= x^3 + y^2+2z^2$ $V= -x^2y - yz –xy$	Apply & Evaluate	10
5	The velocity components in a two-dimensional flow field for an incompressible fluid are expressed as $U= y^3/3 + 2x-x^2y$ $v= xy^2-2y-x^3/3$. a) Show that these functions represent a possible case of an ir-rotational flow. b) Obtain an expression for stream function Ψ c) Obtain an expression for velocity potential Φ	Apply & Evaluate	10
6	For a three-dimensional flow field described by $V = (y^2+z^2)$: + $(x^2+z^2)j$ + $(x^2+y^2)k$ find at (1,2,3). (i) the component of acceleration (ii) the components of rotation	Apply & Evaluate	10
7	In a straight uniform pipe, the discharge is reduced from 0.1 m^3/s to zero in 10 seconds. If the cross-sectional area of the pipe is 200 sq cm, state the nature and value of acceleration.	Apply & Evaluate	10
8	A nozzle is so shaped that the velocity of flow along the centerline changes linearly from 1-5 m/s to 15 m/s in a distance of 0.375. Determine the magnitude of the convective acceleration at the beginning and end of this distance.	Apply & Evaluate	10
9	In a 100mm dia horizontal pipe a venturimeter of 0.5 contraction ratio has been fixed the head of water on the meter when there is no flow is 3m. Find the rate of flow for which the throat pressure will be 2m of water absolute. Take atmospheric pressure head= 10.3m of water. The coefficient of meter is 0.97.	Apply & Evaluate	10

S.No	QUESTIONS	Blooms Taxonomy Level	Program Outcome
10	For a two-dimensional flow Φ = 3xy and x = 3/2 (y^2-x^2). Determine the velocity components at the points (1,3) and (3,3). Also find the discharge passing between the streamlines passing through the points given above.	Apply & Evaluate	10
	UNIT-1V **BOUNDARY LAYER THEORY**		
1	A plate of 600mm length and 400mm wide is immersed in a fluid of specific gravity 0.9 and kinematic viscosity v=$10^{-4}m^{2/s}$. The fluid is moving with a velocity of 6m/s. determine boundary layer thickness , shear stress at the end of the plate and drag force one side of the plate.	Apply & Evaluate	11
2	Air flows at 10m/s past a smooth rectangular flat plate 0.3m wide and 3m long. Assuming that's the turbulence level in the on coming stream is low and that transition occurs at R_e=5 X 10^5, Calculate ratio of total drag when the flow is parallel to the length of the plate to the value when the flow is parallel to the width.	Apply & Evaluate	11
3	Oil with a free stream velocity of 2m/s flows over a thin plate 2m wide and 2m long. Calculate the boundary layer thickness and the shear stress at the trailing end point and determine the total surface resistance of the plate. Take specific gravity 0.86 and kinematic viscosity 10^{-5} m^2/s.	Apply & Evaluate	11
4	A thin plate is moving in still atmospheric air at a velocity of 4m/s. The length of plate is 0.5m and width is 0.4m, calculate the thickness of boundary layer at the end of the plate and the drag force on one side of the plate. Take density of air is 1.25kg/m^3 and kinematic viscosity 0.15 stokes.	Apply & Evaluate	11
8	A smooth flat plate of size 30 cm X 60 cm is placed in a stream of water of uniform velocity 60 cm/sec. Flow takes parallel to the 30 cm length of the plate. If the kinematic viscosity of water is 0.011 stoke, is the boundary layer formed on the plate laminar or turbulent? Determine the shear stress at the trailing edge, maximum boundary layer thickness, mean drag coefficient and the work done by the fluid on one side of the plate per unit time in Joules.	Apply & Evaluate	11
9	A stream lined train is 350 m long and has an average cross-section with a perimeter of 110.2 m above the wheels. Assuming that the boundary layer is completely turbulent, compute the surface drag for a speed of 120 kmph and power required to overcome this drag. Dynamic viscosity of air = 0.000185 poise and specific weight = 12 N/m^3.	Apply & Evaluate	11
10	A smooth flat plate of size 6 m by 3m is towed in a liquid of density 900kg/ m^3 and viscosity 0.12 poises at a uniform velocity of 2.5 m/s. The motion is parallel to the 6 m side of the plate. What is the length of the plate over which the boundary layer is laminar?> Calculate the surface drag on both sides of plate.	Apply & Evaluate	11
	Unit-V **Closed Conduit Flow**		
1	Determine the distance from the pipe wall at which the local velocity is equal to the average velocity for turbulent flow in pipes.	Apply & Evaluate	9
2	A smooth pipe of diameter 400mm and length 800mm carries water at the rate of 0.04m^3/s. determine the head lost due to friction,wall shear stress, centre line velocity and thickness of laminar sublayer. Take kinematic viscosity of water as 0.018 stokes.	Apply & Evaluate	9
3	Water is flowing through a rough pipe of diameter 600mm at the rate 600liters/sec. the wall roughness is 3mm. find the power lost for 1km length of pipe.	Apply & Evaluate	9
4	A 0.3m diameter pipe 2340m long is connected with a reservoir whose surface	Apply &	9

S.No	QUESTIONS	Blooms Taxonomy Level	Program Outcome
	is 72m above the discharging end of the pipe. If for the last 1170m, a second pipe of the same diameter be laid beside the first and connected to it. What would be the increase in the discharge? Take f=0.02	Evaluate	
5	A compound piping system consists of 1800m of 0.50m, 1200m of 0.40m and 600m of 0.30m new cast iron pipes connected in series. Convert the system to (a) an equivalent length of 0.40m pipe and (b) (b) equivalent size pipe 3600m long.	Apply & Evaluate	9
6	A pipe having a length of 6km and diameter 0.70m connects two reservoirs A and B, the difference between their water levels is 30m. Half way along the pipe there is a branch through which water can be supplied to a third reservoir C. Taking f = 0.024 determine the rate of flow of reservoir B when a) no water is discharged to reservoir C b) the quantity of water discharged to reservoir C is 0.15 m^3/s neglect minor losses.	Apply & Evaluate	9
7	A pipeline 0.225 m in diameter and 1580m long has a slope of 1 in 200 for the first 790m and 1 in 100 for the next 790m. The pressure at the upper end of the pipeline is 107.91 kpa and at the lower end is 53.955 kpa. Taking f=0.032 determine the discharge through the pipe.	Apply & Evaluate	9
8	The velocities of water through a pipe of diameter 10cm are 4m/s and 3.5m/s at the centre of the pipe and 2cm from the pipe centre. Determine the wall shearing stress in the pipe for turbulent flow.	Apply & Evaluate	9
9	Determine the average height of the roughness for a rough pipe of diameter 10cm when the velocity at a point 4cm from wall is 40% more than the velocity at a point 1cm from pipe wall.	Apply & Evaluate	9
10	For turbulent flow in a pipe diameter 300mm, find the discharge when the centre line velocity is 2m/s and the velocity at a point 100mm from the centre as measured by pitot tube is 1.6m/s.	Apply & Evaluate	9

Prepared By: Mr. G Anand Reddy, Assistant Professor, Civil Engineering

CIVIL, HOD