VALLIAMMAI ENGINEERING COLLEGE

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF CIVIL ENGINEERING
QUESTION BANK

III SEMESTER

CE 8302 FLUID MECHANICS
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SUBJECT : CE 8302 / FLUID MECHANICS

SEM / YEAR: III/II

UNIT I FLUID PROPERTIES AND FLUID STATICS 9

Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, capillarity and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers-forces on planes – centre of pressure – buoyancy and floatation.

PART – A

Q.No	Questions	BT Level	Competence
1	Define Centre of Pressure	BT-1	Remember
2	Define Mass Density	BT-1	Remember
3	Define Specific volume of fluid and write its unit	BT-1	Remember
4	Define Kinematic Viscosity	BT-1	Remember
5	Define specific gravity	BT-1	Remember
6	Define Buoyancy	BT-1	Remember
7	Classify the Types of fluids	BT-2	Understand
8	Compare specific weight and specific volume	BT-2	Understand
9	Relate absolute pressure and gauge pressure	BT-2	Understand
10	Explain Newton's Law of Viscosity.	BT-2	Understand
11	Name the devices that are used to measure the pressure of a fluid	BT-3	Application
12	How to calculate pressure using differential manometers	BT-3	Application
13	Calculate the specific weight, density and specific gravity of 1 litre of liquid which weighs 7 N.	BT-3	Application
14	Distinguish between gauge pressure and vacuum pressure	BT-4	Analyse
15	Two horizontal plates are placed 1.25 cm apart. The space between them is being filled with oil of viscosity 14 poises. Examine the shear stress in oil if upper plate is moved with a velocity of 2.5 m/s.	BT-4	Analyse
16	Find the Kinematic viscosity of an oil having density 981 kg/m. The shear stress at a point in oil is 0.2452 N/m^2 and velocity gradient at that point is 0.2 /sec.	BT-4	Analyse
17	Determine the specific gravity of a fluid having viscosity 0.005 Ns/m^2 and kinematic viscosity $0.035*10^{-4} m^2/s$.	BT-5	Evaluate
18	The Capillary rise in the glass tube is not to exceed 0.2 mm of water. Determine its minimum size, given that surface tension of water in contact with air = 0.0725 N/m	BT-5	Evaluate
19	Write down the expression for capillary fall in terms of surface tension for mercury.	BT-6	Create
20	Temperature rise, decreases viscosity in liquids but increases in gases, why?	BT-6	Create

PART –B			
1	Find the density of a metallic body which floats at the interface of mercury of sp.gr. 13.6 and water such that 40% of its volume is sub – merged in mercury and 60% in water.	BT-1	Remember
2	Two large plane surfaces are 2.4 cm apart. The space between the gap is filled with glycerin. What force is required to drag a thin plate of size 0.5 m between two large plane surfaces at a speed of 0.6 m/sec. if the thin plate is a) In the middle gap (7) b) Thin plate is 0.8 cm from one of the plane surfaces? (6) Take dynamic viscosity of fluid is 8.1 poise.	BT-1	Remember
3	If the Velocity distribution of a fluid over a plate is given by u = ay^2+by+c with a vertex 0.2m from the plate, where the velocity is 1.2 m/s. Calculate the velocity gradient and shear stress at a distance of 0m 0.1m 0.2m from the plate. If the viscosity of the fluid is 0.85 Ns/m^2	BT-1	Remember
4	A plate 0.05 nm distance from a fixed plates moves at 600 mm/s and requires a force of 3N per unit area to maintain this speed. Determine the fluid viscosity between the plates. Also find the specified weight of the above fluid, if the kinetic viscosity of the fluid is 0.003× 10-4 m^2/s	BT-1	Remember
5	A circular plate 1.2 m diameter is placed vertically in water so that the centre of plate is 2m below the free surface. Determine the total pressure and depth of the centre of pressure	BT-2	Understand
6	A liquid has a specific gravity of 0.72. Find its density, specific weight and also the weight per litre of the liquid. If the above liquid is used for lubricant between a shaft and a sleeve, find the power lost in liquid for a sleeve length of 100 mm. The diameter of the shaft is 0.5m and the thickness of the liquid film is 1 mm. Take the viscosity of fluid as 0.5 N/ m2 and the speed of the shaft as 200 rpm	BT-2	Understand
7	Derive an expression for the capillary rise of a liquid having surface tension σ and contact angle θ between two vertical parallel plates at a distance W apart. If the plates are of glass, what will be the capillary raises of water? Assume σ = 0.773 N/m, θ = 0˚ take W= 1mm.	BT-2	Understand
8	Calculate the capillary effect in millimetres in a glass tube of 4mm diameter, when immersed in(i) water and (ii) mercury the temperature of the liquid is 20^o in contact with air are 0.073575 N/m and 0.51 N/m respectively. The angle of contact for water is zero and that for mercury is 130^o. Take density of water at 20^o as equal to 998 kg/m3	BT-3	Application
9	i) Identify the capillary effect in millimeters a glass tube of 4mm diameter, when immersed in (a) water (b) mercury. The temperature of the liquid is 20°C and the values of the surface tension of water and mercury at 20°C in contact with air are 0.073575 and 0.51N/m respectively. The angle of contact for water is zero that for mercury $130^\circ C$. Take specific weight of water as 9790 N/m^3. (7) ii) A 400mm diameter shaft is rotating at 200 rpm in a bearing of length 120mm. if the thickness of oil film is 1.5mm and the dynamic viscosity of the oil is 0.7 $N.S/m^2$. Determine the torque required overcoming friction in bearing and power utilized in overcoming viscous resistance. Assume a linear velocity profile.	BT-3	Application

10	i) If the velocity distribution over a plate is given by u=2/3 y – y^2 in which u is the velocity in m/s at a distance y meter above the plate, determine the shear stress at y=0 and y=0.15 m. Take dynamic viscosity of fluid as 8.63 poises. (6) ii) Derive an expression for Pascal’s law. (7)	BT-4	Analyse
11	Calculate the dynamic viscosity of oil which is used for lubrication 30°. The weight of the square plates is 330 N and it slide down the inclined plane with uniform velocity of 0.3 m/s. Thickness of the oil film is 1.5 mm.	BT-4	Analyse
12	A U - Tube manometer is used to measure the pressure of water in a pipe line, which is in excess of atmospheric pressure. The right limb of the manometer contains mercury and its open to atmosphere. The contact between water and mercury is in the left limb. Determine the pressure of water in the main line, if the difference in level of mercury in the limbs of U-tube is 10 cm and the free surface of mercury is in level with the centre of the pipe. If the pressure of water in pipe line is reduced to 9810 N/m^2, Calculate the new difference in the level of mercury. Sketch the arrangement in both cases.	BT-4	Analyse
13	(i) Determine the total pressure on a circular plate of diameter 1.5 m which is placed vertically in water in such a way that the centre of the plate is 3 m below the free surface of water. Also find the position of centre of pressure. (7) (ii) Determine the total pressure and centre of pressure on an isosceles triangular plate of base 4m and altitude 4 m when it is immersed vertically in an oil of sp.gr 0.9. The base of the plate is coincides with the free surface of oil. (6)	BT-5	Evaluate
14	i) The dynamic viscosity of oil, used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.4 m and rotates at 190 rpm. Calculate the power lost in the bearing for a sleeve length of 90mm. The thickness of the oil film is 1.5 mm. (7) ii) Derive the expression for pressure head when fluid at a rest. (6)	BT-6	Create
	PART-C		
1	(i) Explain the characteristics of non-Newtonian fluids in detail? (3) (ii) The velocity distribution for flow over a plate is given by U= 2y-y^2 where U is the velocity in m/s at a distance y meters above the plate. Determine the velocity gradient and shear stress at the boundary and 0.15m from it. (12)	BT-1	Remember
2	i) The dynamic viscosity of oil, used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.4 m and rotates at 190 rpm. Calculate the power lost in the bearing for a sleeve length of 90mm. The thickness of the oil film is 1.5 mm. (8) ii) Derive the expression for pressure head when fluid at a rest. (7)	BT-2	Understand
3	Derive an expression for the depth of centre of pressure from free surface of liquid of an inclined plane surface submerged in the liquid.	BT-3	Application
4	(i) Derive an expression for the pressure inside a droplet, hollow bubble and a free jet. (10) (ii) Show the rheological classification of fluids and define each type of fluid by giving an example? (5)	BT-4	Analyse

UNIT II	FLUID KINEMATICS AND DYNAMICS	9

Fluid Kinematics – Classification and types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms)- stream line-streak line-path line- stream function - velocity potential function - flow net. Fluid dynamics - equations of motion -Euler's equation along a streamline - Bernoulli's equation – application – venture meter, orifice meter and Pitot tube- linear momentum equation and its application to pipe bend.

PART – A

Q.No	Questions	BT Level	Competence
1	Define flow net	BT-1	Remember
2	Write Euler's equation.	BT-1	Remember
3	Define Pitot – tube	BT-1	Remember
4	Define "Vortex flow"	BT-1	Remember
5	Define Stream function	BT-1	Remember
6	What are the assumptions made in the derivation of Bernoulli's equation?	BT-1	Remember
7	Classify the types of Motion	BT-2	Understand
8	Explain the impulse momentum principle	BT-2	Understand
9	Compare Laminar flow and turbulent flow	BT-2	Understand
10	Write and infer the equations of motion	BT-2	Understand
11	Application of Bernoulli's theorem for steady flow of an incompressible fluid.	BT-3	Application
12	Write the properties of stream function	BT-3	Application
13	Define circulation and write its expressions	BT-3	Application
14	Distinguish between stream line and streak line.	BT-4	Analyse
15	Distinguish between uniform and non-uniform flow	BT-4	Analyse
16	What do you understand by Continuity Equation?	BT-4	Analyse
17	A pitot – static tube is used to measure the velocity of water in a pipe. The stagnation pressure head is 6mm and static pressure head is 5m. Calculate the velocity of flow assuming the co-efficient of tube equal to 0.98.	BT-5	Evaluate
18	A differential manometer is connected at the two points A and B. At B pressure is 9.81 N/cm2 (abs), find the absolute pressure at A	BT-5	Evaluate
19	Write the expression for the resultant force acting between two sections of the pipe in terms of discharge using impulse-momentum principle.	BT-6	Create
20	Write Euler's equation.	BT-6	Create

PART -B

1	Water flow through a pipe AB 1.2 diameter at 3m/s and then passes through a pipe BC 105m diameter. At C, the pipe branch CD is 0.8m in diameter and carries one third of flow in AB. The flow velocity in branch CE is 2.5 m/s. Find the volume rate in B.C, the velocity in CD and the diameter of CE	BT-1	Remember
2	State Bernoulli's theorem for steady flow of a incompressible third.Derive an expression for Bernoulli's equation from first principle and state the assumption made for such a derivation	BT-4	Analyse
3	The stream function for a dimensional flow is given by Ψ =2xy. Calculate the resultant velocity at P(3,4). Also the velocity potential function ϕ.	BT-3	Application
4	A venture meter of inlet diameter 300mm and throat diameter 150mm is inserted in vertical pipe carrying in the upward direction. A different mercury manometer connected to the inlet and throat gives a reading of 200mm. Find the discharge if the coefficient of discharge of meter is 0.98	BT-2	Understand
5	A ripple 200 m long slop down at 1 in 100 and taper from 600 mm diameter at the higher end to 300 mm diameter at the lower end, and carries 100 litres/ sec of oil having specified gravity 0.8. If the pressure gauge at the higher end reads 60 kN/m2, determine the velocities at the two ends and also the pressure at the lower end	BT-2	Understand
6	Briefly describe about velocity potential function and stream function and its relations.	BT-2	Understand
7	A horizontal venturi meter with inlet diameter 250 mm and throatdiameter 120mm is used to measure the flow of oil specific gravity 0.85. The discharge of oil through the venture meter is 80 lit/sec. Find the reading of oil – mercury differential manometer. Take Cd =0.97	BT-2	Understand
8	If for a two – diamantine potential flow, the velocity potential is given by $\phi = x\,(2y - 1)$ determine the velocity at the point P(4,5). Determine also the value of stream function Ψ at the point P.	BT-3	Application
9	The velocity component for a two dimensional incompressible flow are given by u =3x – 2y and v = -3y – 2x. Show that the velocity potential exists. Determine the velocity potential function and stream function.	BT-3	Application
10	An oil of sp .Gr. 0.8 is flowing through a venturimeter having an inlet diameter 20 cm and throat diameter 10 cm. The oil mercury differential manometer shows a reading of 25 cm. Examine the discharge of oil through the horizontal venturimeter, Take CD = 0.98.	BT-4	Analyse

11	(i) A pitot static tube is used to measure the velocity of water in a pipe. The stagnation pressure head is 6m and static pressure head is 5m. Calculate the velocity of flow assuming the coefficient of tube equal to 0.98. (ii) An orifice meter with orifice diameter 15cm is inserted in a pipe of 30 cm diameter. The pressure difference measured by a mercury oil differential manometer on the two sides of the orifice meter gives a reading of 50 cm of mercury. Fine the rate of flow of oil of sp.gr 0.9 When the coefficient of discharge of the orifice meter = 0.64.	BT-4	Analyse
12	A 400 x 200 mm venturimeter is provided in a vertical pipe line carrying oil of relative density 0.9, the flow being upwards. The difference in elevation of the throat section and entrance section of the venturimeter is 30 cm. The differential U tube mercury manometer shows a gauge deflection of 250 mm. calculate the discharge of oil, if the coefficient of meter is 0.98.	BT-4	Analyse
13	(i) A two dimensional flow is described by the velocity components, u = 5x3 and v = -15x2y. Determine the stream function, velocity and acceleration at point P (x= 1m ; y = 2m) (7) (ii) A 40 cm diameter pipe, conveying water, branches into two pipes of diameters 30cm and 20cm respectively. If the average velocity in the 40 cm diameter pipe is 3m/s, find the discharge in this pipe. Also determine the velocity in 20 cm pipe if the average velocity in the 30 cm diameter pipe is 2m/s. (6)	BT-5	Evaluate
14	Derive continuity equation from principle of conservation of mass	BT-6	Create
	PART-C		
1.	If for a two dimensional potential flow, the velocity potential function is given by ϕ = x (2y-1), determine the velocity at the point P (4,5). Determine also the value of stream function (Ψ) at the point P.	BT-1	Remember
2.	The water is flowing through a pipe having diameter 20 cm and10cm at sections 1 and 2 respectively. The rate of flow through pipe is 3.5 lits/sec. This section 1 is 6 m above datum and section 2 is 4 m above datum. If the pressure at section 1 is 39.24 N/cm2, find the intensity of pressure at section 2.	BT-3	Application
3.	The inlet and throat diameter of a horizontal venturimeter are 30cm and 10 cm respectively. The Liquid flowing through the meter is water. The pressure intensity at inlet is 13.734 N/cm2. While the vacuum pressure head at the throat is 37cm of mercury. Find the rate of flow. Assume that 4% of the differential head is lost between the inlet and throat. Find also the value of Cd for the venture meter.	BT-4	Analyse
4.	The water is flowing through a taper pipe of length 100 m having diameter 600 mm at the upper end and 300 mm at the lower end, At the rate of 50 lit/sec. The pipe has a slope of 1 in 30. Find the pressure at the pressure at the lower end if the pressure at the higher level is 19.62 N/m2	BT-2	Understand

UNIT III	DIMENSIONAL ANALYSIS AND MODEL STUDIES	9
Fundamental dimensions - dimensional homogeneity - Rayleigh's method and Buckingham Pi- theorem - dimensionless parameters - similitudes and model studies - distorted models.		

Part A

Q.No	Questions	BT Level	Competence
1	Define the term dimensional homogeneity. What are the uses of dimensional homogeneity?	BT-1	Remembering
2	Distinguish between Geometric similarity and Kinematic similarity.	BT-4	Analyzing
3	List the steps in determining the π groups.	BT-1	Remembering
4	Examine whether the equation $V = \sqrt{2gH}$ is dimensionally homogenous.	BT-4	Analyzing
5	Classify the methods of dimensional analysis.	BT-2	Understanding
6	Define Similitude and Scale ratio.	BT-1	Remembering
7	Evaluate the dimensions of the following physical quantities: a. Pressure b. Surface tension c. Dynamic viscosity d. Kinematic viscosity	BT-5	Evaluating
8	Write short note on Dynamic similarity.	BT-3	Applying
9	Explain about model and model analysis.	BT-2	Understanding
10	Define dimensionless numbers and list any two dimensionless numbers	BT-1	Remembering
11	Illustrate the three demerits of a distorted model.	BT-2	Understanding
12	Write two examples of a fluid flow situation where Froude model law is applied.	BT-6	Creating
13	Distinguish between model and prototype.	BT-4	Analyzing
14	State the Buckingham's π-theorem.	BT-1	Remembering
15	Define Reynold's number.	BT-1	Remembering
16	Apply the significance of Reynolds number and Prandtl number.	BT-3	Applying
17	Explain the advantages of model testing.	BT-5	Evaluating
18	Write short note on distorted model and undistorted model.	BT-3	Applying
19	Develop the expression for Froude number	BT-6	Creating
20	Show the applications of model testing.	BT-2	Understanding

PART –B

1.	i. Define and explain about the Buckingham's π-theorem. ii. Check the dimensional homogeneity of the following common equations in the field of hydraulics. a) $Q = Cd.\ a.\sqrt{2gH}$ b) $V = C$	BT-1	Remembering
2.	The efficiency η of a fan depends on density 'ρ', dynamic viscosity 'μ', and angular velocity 'ω', diameter D of the rotor and the discharge Q. Evaluate η in terms of dimensionless parameters using Buckingham's π method.	BT-5	Evaluating

3.	The resisting force (R) of a supersonic flight can be considered as dependent upon length of aircraft (l), velocity (V), air viscosity ‘μ’, air density ‘ρ’, and bulk modulus of air ‘ k’. State the functional relationship between these variables and the resisting force.	BT-1	Remembering
4.	By dimensional analysis, Show that the power P developed by a hydraulic turbine is given by P = ρN3D5f [N2 D2/ gH] where ρ - mass density of liquid, N - rotational speed, D – diameter of runner, H working head and g - acceleration due to gravity.	BT-3	Applying
5.	A 7.2 m height and 15 m long spillway discharge 94 m3/s, under a head of 2 m. If a 1:9 scale model of this spillway is to be constructed, determine model dimensions, head over spillway model and the model discharge. If model experience a force of 7500N, Calculate the force on the prototype.	BT-3	Applying
6.	The variables controlling the motion of a floating vessel through water the drag force F, speed V, length L, density ρ, and dynamic viscosity μ of water and acceleration due to gravity g. Construct an expression for F by dimensional analysis.	BT-6	Creating
7.	Using Buckingham’s π theorem, Examine whether the velocity through a circular pipe orifice is given by, V = √2gHϕ [D/H , μ/ ρvH] where H = Head causing flow, D = diameter of orifice, μ = coefficient of viscosity ρ = mass density, g = acceleration due to gravity.	BT-4	Analyzing
8.	i. An oil of specific gravity 0.91 and viscosity of 0.03 poise is to be transported at the rate of 3 m3/s through a 1.3 m diameter pipe, Model tests were conducted on 130 mm diameter pipe using water having a viscosity of 0.01 poise. Estimate the velocity of flow and discharge in the model. ii. Discuss briefly the three types of Similarities between the model and the prototype.	BT-2	Understanding
9.	i. What is a distorted model? How it differs from an undistorted model. Discuss the advantages and disadvantages of distorted models. (5) ii. A spill way model built upto a scale of 1/10 is discharging water with a velocity of 1 m/s, under a head of 100 mm. Estimate the velocity of water of the prototype, if the head of water over the prototype is 5.5 m. (8)	BT-2	Understanding
10.	The frictional torque T of a disc diameter D rotating at a speed N in a fluid of viscosity μ and density ρ in a turbulent flow is given by T = D5 N2ρ ϕ [μ/ D2N ρ]. Prove this by the method of dimensions.	BT-4	Analyzing
11	It is desired to obtain the dynamic similarity between a 30 cm diameter pipe carrying linseed oil at 0.5 m3/s and a 5 m diameter pipe carrying water. What should be the rate of flow of water in lps. If the pressure loss in the model is 196 N/m2, Estimate the pressure loss in the prototype pipe. Kinematic viscosities of linseed oil and water are 0.457 and 0.0113 stokes respectively. Specific gravity of linseed oil 0.82.	BT-2	Understanding
12	A spillway model is to be built to a scale ratio of 1:40 across a flume of 600 mm width. The prototype is 10 m high and maximum head expected is 1.5 m. i. Calculate the height of the model and the head on the model. ii. Calculate the flow over the prototype when the flow over the model is 12 lps. iii. If a negative pressure of 0.15 m occurs in the model, what will be the negative pressure in the prototype? Is this practically possible to occur. State it.	BT-1	Remembering
13	i. The pressure drop in an aeroplane model of size 1/10 of its prototype is 80 N/cm2. The model is tested in water. Analyse the corresponding pressure drop in the prototype. Take density of air = 1.24 kg/m3. The viscosity of water is 0.01 poise while the viscosity of air is 0.00018 poise. (7) ii. A 1.64 model is constructed on open channel in concrete which has manning’s N = 0.014. Find the value of N for the models. (6)	BT-4	Analyzing

14	i. A pipe of dia 1.5 m is required to transport an oil of specific gravity 0.9 and viscosity 3x 10-2 poise at the rate of 3000 l/s. Tests were conducted on 15cm diameter by using water at 200c. Find the velocity and rate of flow in the model. Viscosity of water at 200c= 0.01 poise (8) ii. List out the types of forces acting in a moving fluid and explain it briefly.	BT-1	Remembering
	PART-C		
1.	Define Similitude and discuss its type of similarities in detail.	BT-1	Remembering
2.	The efficiency ŋ of geometrically similar fans depends upon the mass density of air ƿ , its viscosity μ , speed of the fan N (revolutions per second) , diameter of blades D and discharge Q . Perform dimensional analysis using Buckingham's theorem.	BT-3	Applying
3.	Discuss the types of non-dimensional numbers and derive any two of them. Also explain the significances of these dimensionless numbers for fluid flow problem.	BT-2	Understanding
4.	Consider the problem of computing the drag force on a body moving through a fluid. Let D, ρ, μ, l, and V be drag force, specific mass of the fluid, dynamic viscosity of the fluid, body reference length, and body velocity, respectively..	BT-4	Analyzing

UNIT IV FLOW THROUGH PIPES **9**

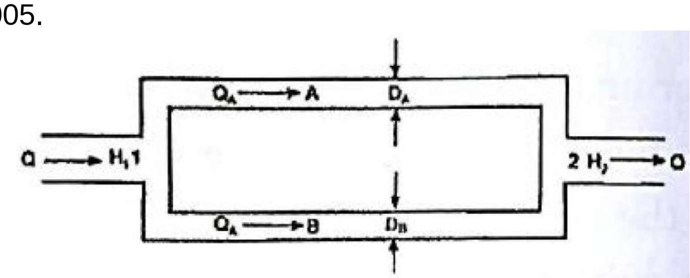
Reynold’s experiment - laminar flow through circular pipe (Hagen poiseulle's) - hydraulic and energ gradient – flow through pipes - Darcy - Weisbach's equation - pipe roughness -friction factor- Moody' diagram- major and minor losses of flow in pipes - pipes in series and in parallel.

PART -A

Q.No	Questions	BT Level	Competence
1.	Name the characteristics of laminar flow.	BT-1	Remember
2.	Describe the factors to be determined when viscous fluid flows through the circular pipe.	BT-1	Remember
3.	Define H.G.L	BT-1	Remember
4.	Define Reynolds number	BT-1	Remember
5.	Define the term ‘Vena Contract’.	BT-1	Remember
6.	Define a) pipes in series b) pipes in parallel?	BT-1	Remember
7.	Differentiate Major and Minor head loss	BT-2	Understand
8.	Predict the head lost due to friction in a pipe of diameter 300 mm and length 50 m, through which water is flowing at a velocity of 3 m/s. Take kinematic viscosity of water is 0.01 stoke.	BT-2	Understand
9.	Differentiate laminar and turbulent flow.	BT-2	Understand
10.	Describe Darcy formula. How will you interpret the loss of head due to friction in pipes?	BT-2	Understand
11.	Using Hagen Poisuille’s derivation, show the formula for average velocity and velocity distribution.	BT-3	Application
12.	Illustrate the expression for drop of pressure for a given length of a pipe.	BT-3	Application
13.	Relate an expression for co efficient of friction in terms of shear stress.	BT-3	Application
14.	Compare hydraulic gradient line with total energy line.	BT-4	Analyse
15.	Explain the significance of Moody diagram.	BT-4	Analyse
16.	Explain the terms a) major energy loss, b) minor energy loss.	BT-4	Analyse
17.	Formulate Hagen Poisuille’s equation.	BT-5	Evaluate
18.	Formulate an expression for loss of head due to sudden enlargement and sudden contraction of the pipes.	BT-5	Evaluate
19.	Summarize the properties of pipe roughness	BT-6	Create
20.	Draw and assess the shear stress and velocity distribution diagram for the viscous flow in a circular conduit.	BT-6	Create

PART –B

1.	An oil of Sp.Gr 0.9 and viscosity 0.06 poise is flowing through a pipe of diameter 200 mm at the rate of 60 liters/sec. Identify the head lost due to friction for a 500 m length of pipe. Also identify the power required to maintain this flow.	BT-1	Remember
2.	Examine the head lost due to friction in a pipe of diameter 300mm and length 50m, through which water is flowing at a velocity of 3m/s using (i) Darcy formula, (ii) Chezy’s formula for which C = 60.	BT-1	Remember

3.	An oil of viscosity 0.1NS/m2 and relative density 0.9 is flowing through a circular pipe of diameter 5cm and of length 300m. The rate of flow of fluid through the pipe is 3.5 liters/sec. Examine the pressure drop in a length of 300 m and also the shear stress at the pipe wall.	BT-1	Remember
4.	The rate of flow of water through a horizontal pipe is 0.25 m^3/s. The diameter of the pipe which is 200 mm is suddenly enlarged to 400 mm. The pressure intensity in the smaller is 11.772 N/cm^2. Identify the (i) loss of head due to sudden enlargement, (ii) pressure intensity in the large pipe, (iii) power lost due to enlargement.	BT-1	Remember
5.	i) A crude oil of kinematic viscosity 0.4 stoke is flowing through a pipe of diameter 300 mm at the rate of 300 litres per sec. Estimate the head lost due to friction for a length of 50 m of the pipe. (7) ii) An oil of viscosity 1 N-s/m2 flows between two parallel fixed plates which are kept at a distance of 50 mm apart. Estimate the discharge of oil between the plates. If the drop of pressure in a length of 1.2m be 3 kN/m2. The width of the plate is 200mm. (6)	BT-2	Understand
6.	The difference in water surface levels in two tanks, which are connected by three pipes in series of lengths 300 m, 170 m and 210 m and of diameters 300 mm, 200 mm and 400 mm respectively, is 12m. Estimate the rate of flow of water if co – efficient of friction are 0.005, 0.0052 and 0.0048 respectively, considering: (i) minor losses also (ii) neglecting minor losses.	BT-2	Understand
7.	Two pipes of diameter 400mm and 200mm are each 300m long. When the pipes are connected in series the discharge through the pipeline is 0.10m3/sec, Estimate the loss of head incurred. What would be the loss of head in the system to pass the same total discharge when the pipes are connected in parallel. Take friction factor = 0.0075 for each pipe.	BT-2	Understand
8.	Derive an expression for the loss of head due to sudden enlargement and sudden contraction of a pipe.	BT-3	Application
9.	A main pipe divides into 2 parallel pipes which again forms one pipe as shown in fig. the length and diameter for the 1st parallel pipe are 2000 m and 1 m respectively, while the length and diameter of 2nd parallel pipe are 2000 m and 0.8 m. Calculate the rate of flow in each parallel pipe, if the total flow in the main is 3 m^3/s. the coefficient of friction for each parallel pipe is same and equal to 0.005. 	BT-3	Application
10.	A pipe of diameter 20 cm and length 2000 m is connects two reservoirs, having difference of water levels as 20 m. Analyse the discharge through the pipe. If an additional pipe of diameter 20 cm and length 1200 m is attached to the last 1200 m length of the existing pipe, find the increase in the discharge. Take f = 0.015 and neglect minor losses.	BT-4	Analyse
11.	A pipe line of 0.6 m diameter is 1.5 km long. To increase the discharge another line of the same diameter is introduced parallel to the first in the second half of the length. Neglecting minor losses, analyse the increase in discharge if 4f = 0.04. The head at inlet is 300 mm.	BT-4	Analyse

12.	Analyse the rate of flow of water through a pipe of diameter 20 cm and length 50 m when one end of the pipe is connected to a tank and other end of the pipe is open to the atmosphere. The pipe is horizontal and the height of water in the tank is 4 m above the center of the pipe. Consider all minor losses and take f = 0.009 in the formula $h_f = (4fLV^2)/(2gd)$	BT-4	Analyse
13.	A pipe of diameter 20 cm and length 2000 m is connects two reservoirs, having difference of water levels as 20 m. design the discharge through the pipe. If an additional pipe of diameter 20 cm and length 1200 m is attached to the last 1200 m length of the existing pipe, compose the increase in the discharge. Take f = 0.015 and neglect minor losses.	BT-5	Evaluate
14.	i) If a pipe line of 300 mm diameter and 3200 m long is used to pump up 50 kg per second of oil whose density is 950 kg/m^3 and whose kinematic viscosity is 2.1 stokes, the center of the pipe line at the upper end is 40 m above than that at the lower end and the discharge at upper end is atmospheric, decide the pressure at the lower end & draw and assess the hydraulic gradient and the total energy line. (9) ii) A pipe line 60 cm diameter bifurcates at a Y- junction into two branches 40 cm and 30 cm in diameter. If the rate of flow in the main pipe is 1.5 m^3/s and mean velocity of flow in 30 cm diameter pipe is 7.5 m/s, measure the rate of flow in the 40 cm diameter pipe. (4)	BT-6	Create
	PART –C		
1.	Derive an expression for Hagen Poisuille's equation.	BT-3	Apply
2.	i) Compare chezy's formula with Darcy's formula. (5) ii) Expalin an expression for the Darcy weisbach equation. (10)	BT-4	Analyse
3.	Design the loss of head if the pipes are connected in series (compound pipes), equivalent and in parallel.	BT-5	Analyse
4.	A horizontal pipe line 40 m long is connected to a water tank at one end discharges freely into the atmosphere at the other end. For the first 25 m of its length from the tank, the pipe is 150 mm diameter and its diameter is suddenly enlarged to 300 mm. The height of water level in the tank is 8 m above the centre of the pipe. Considering all losses of head which occur, measure the rate of flow (discharge). Take Darcy's co-efficient of friction as 0.01 for both sections of the pipe.	BT-6	Create

UNIT V BOUNDARY LAYER			9
Boundary layer – definition- boundary layer on a flat plate – laminar and turbulent boundary layer- displacement, energy and momentum thickness – Momentum integral equation-Boundary layer separation and control – drag on flat plate.			
Part A			
Q.No	**Questions**	**BT Level**	Competence
1.	List out the methods of preventing the separation of a Boundary layer.	BT-1	Remember
2.	List out the assumptions made in the analysis of boundary layer development.	BT-1	Remember
3.	Describe the term Laminar Sub – layer?	BT-1	Remember
4.	Define boundary layer thickness	BT-1	Remember
5.	List out the conditions for separation of boundary layer.	BT-1	Remember
6.	Define energy thickness.	BT-1	Remember
7.	Differentiate displacement thickness and energy thickness.	BT-2	Understand
8.	Differentiate between Laminar boundary layer and turbulent boundary layer.	BT-2	Understand
9.	Distinguish between local co-efficient of drag and average co-efficient of drag.	BT-2	Understand
10.	Discuss about the applications of Von Karman momentum integral equation.	BT-2	Understand
11.	Illustrate the term "Boundary Layer".	BT-3	Application
12.	Illustrate the terms: Drag and Lift.	BT-3	Application
13.	Illustrate the examples of formation of boundary layer in day to day life.	BT-3	Application
14.	Explain the diagram for drag force on a plate due to boundary layer.	BT-4	Analyse
15.	Infer how the drag and lift acting on a body moving in a fluid of density ρ at a uniform velocity U are calculated mathematically.	BT-4	Analyse
16.	Explain the Boundary layer theory.	BT-4	Analyse
17.	Generalize the drag force from a lift force?	BT-5	Evaluate
18.	Formulate the values of boundary layer thickness and drag co – efficient for Blasius's solution.	BT-5	Evaluate
19.	Assess the Von Karman momentum integral equation.	BT-6	Create
20.	Recommend the boundary conditions for the velocity profiles.	BT-6	Create
PART – B			
1.	For the velocity profile for laminar boundary layer $u/U = (3/2)(y/\delta) - (1/2)(y/\delta)^3$. Identify the boundary layer thickness, shear stress, drag force and coefficient of drag in terms of Reynold Number.	BT-1	Remember
2.	Air is flowing over a flat plate 500 mm long and 600 mm wide with a velocity of 4 m/s. The kinematic viscosity of air is given as 0.15×10^{-4} m^2/s. Identify i) the boundary layer thickness at the end of the plate, ii) shear stress at 200 mm from the leading edge and iii) drag force on one side of the plate. Take the velocity profile over the plate as $u/U = \sin(\pi/2 y/\delta)$ and density of air is 1.24 kg/m^3.	BT-1	Remember

3.	For the following velocity profiles, Examine whether the flow has or on the verge of separation or will attach with the surface: i) $u/U = 3/2\,(y/\delta) - 1/2\,(y/\delta)^3$ ii) $u/U = 2\,(y/\delta)^2 - (y/\delta)^3$ iii) $u/U = -2\,(y/\delta) + (y/\delta)^2$	BT-1	Remember
4.	Define the terms displacement thickness and momentum thickness and also derive an expression for the displacement thickness and momentum thickness in boundary layer with necessary assumptions.	BT-1	Remember
5.	Discuss the concept of boundary layer formation, derive the expression for displacement thickness and list the methods of boundary layer separation.	BT-2	Understand
6.	For the velocity profile for laminar boundary layer $u/U = 3/2\,(y/\delta) - 1/2\,(y/\delta)^3$ find the thickness of the boundary layer and the shear stress 1.5 m from the leading edge of a plate. The plate is 2 m long and 1.4 m wide and is placed in water which is moving with a velocity of 200 mm per second. Estimate the total drag force on the plate if μ for water = 0.01 poise.	BT-2	Understand
7.	A plate of length 750 mm and width 250 mm has been placed longitudinally in a stream of crude oil which flows with a velocity of 5 m/s. If the crude oil has a specific gravity of 0.8 and kinematic viscosity of 1 stoke, Estimate: i) Boundary layer thickness at the middle of the plate. ii) Shear stress at the middle of the plate. iii) Friction drag on one side of the plate.	BT-2	Understand
8.	i) Calculate the thickness of the boundary layer at the trailing edge of smooth plate of length 4 m and of the width 1.5 m, when the plate is moving with a velocity of 4 m/s in stationary air. Take kinematic viscosity of air as 1.5×10^{-5} m^2/s. (7) ii) Oil with a free-stream velocity of 3 m/s flows over a thin plate of 1.25 m wide and 2 m long. Calculate the boundary layer thickness at mid length and also calculate the total double sided resistance of the plate. Take density as 860 kg/m^3 and kinematic viscosity as 10^{-5} m^2/s. (6)	BT-3	Application
9.	For the velocity profile for laminar boundary layer $u/U = 2(y/\delta) - 2(y/\delta)^3 + (y/\delta)^4$ derive an expression for boundary layer thickness, shear stress, drag force on one side of the plate and co – efficient of drag in terms of Reynold number.	BT-3	Application
10.	Analyze the displacement thickness, the momentum thickness and energy thickness for the velocity distribution in the boundary layer given by $u/U = y/\delta$, where u is the velocity at a distance y from the plate and u = U at y = δ, where δ = boundary layer thickness. Also calculate the value of δ^*/θ.	BT-4	Analyse
11.	Analyze the displacement thickness, the momentum thickness and energy thickness for the velocity distribution in the boundary layer given by $u/U = 2\,(y/\delta) - (y/\delta)^2$.	BT-4	Analyse
12.	Analyze the following boundary layer parameters for the velocity distribution $u/U = (y/\delta)^{2/3}$: i) Displacement thickness, ii) Momentum thickness, iii) Energy thickness, iv) Shape factor.	BT-4	Analyse

13.	A plate of 600 mm length and 400 mm wide is immersed in a fluid of sp.gr 0.9 and kinematic viscosity v= $10^{-4} m^2/s$. The fluid is moving with the velocity of 6m/s. Design: (i) BL thickness (ii) Shear stress at the end of the plate (iii) Drag force on one of the sides of the plate.	BT-5	Evaluate
14.	A flat plate of 2 m width and 5 m length is kept parallel to air flowing at 4 m/s velocity. Measure i) The length of the plate over which the boundary layer is laminar ii) Boundary layer thickness iii) Shear stress Take density = 1.2 kg/m^3 and kinematic viscosity as 1.4×10^{-5} m^2/s.	BT-6	Create
PART –C			
1.	A thin plate is moving in still atmospheric air at a velocity of 5 m/s. The length of the plate is 0.6 m and width is 0.5 m. Estimate : i) The thickness of the boundary layer at the end of the plate ii) Drag force on one side of the plate. Take density of air as 1.24 kg/m^3 and kinematic viscosity of 0.15 stokes.	BT-2	Understand
2.	Analyze an expression for a drag force on a flat plate due to boundary layer.	BT-4	Analyse
3.	Briefly explain the terms i) Laminar Boundary Layer ii) Turbulent Boundary Layer iii) Boundary Layer Thickness iv) Laminar Sub-Layer	BT-4	Analyse
4.	Formulate an expression for Von Karman momentum integral equation.	BT-5	Evaluate

VALLIAMMAI ENGINEERING COLLEGE

DEPARTMENT OF CIVILENGINEERING

CE 6002 CONCRETE TECHNOLOGY QUESTION BANK

S.no	UNIT NO.		BT1	BT2	BT3	BT4	BT5	BT6	Total Question
1	**Unit-1**	Part-A	6	4	3	3	2	2	20
		Part-B	4	3	2	3	1	1	14
		Part-C	1	1	1	1			4
2	**Unit-2**	Part-A	6	4	3	3	2	2	20
		Part-B	4	3	2	3	1	1	14
		Part- C	1	1	1	1			4
3	**Unit-3**	Part-A	6	4	3	3	2	2	20
		Part-B	4	3	2	3	1	1	14
		Part- C			1	1	1	1	4
4	**Unit-4**	Part-A	6	4	3	3	2	2	20
		Part-B	4	3	2	3	1	1	14
		Part- C	1			1	1	1	4
5	**Unit-5**	Part-A	6	4	3	3	2	2	20
		Part-B	4	3	2	3	1	1	14
		Part- C	1	1		1		1	4

TOTAL NO.OF QUESTIONS IN EACH PART	
PART A	100
PART B	70
PART C	20
TOTAL	190