University of Mumbai
Examination First Half 2022

Program: **BE Civil** Curriculum Scheme: **Rev2019**
Examination: SE Semester: **IV** Course Code: **CEC 405**
Course Name: **Fluid Mechanics II**

Question Bank

Multiple Choice Questions

Q1	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1	A pipe is suddenly enlarged and If velocity of smaller pipe is 4.426 m/s and larger pipe is 1.593 m/s. find out entrance loss and friction loss in first pipe. If coefficient of friction is 0.008 for both pipes
Option A:	6.656 m, 0.5 m
Option B:	0.5 m , 6.656m
Option C:	0.35m, 4.565m
Option D:	4.565 m, 0.35 m
2	For a laminar flow through pipe, the shear stress over the cross section
Option A:	Varies inversely as the distance from the center of pipe
Option B:	Varies directly as the distance from the surface of the pipe
Option C:	Varies directly as the distance from the center of the pipe
Option D:	Remains constant over the cross section
3	The moment of momentum equation is used for
Option A:	water hammer phenomenon
Option B:	design of syphon pipe system
Option C:	studying drag and lift forces
Option D:	analysis of flow problems in turbines and centrifugal pumps
4	Hydraulic gradient line represents the sum of
Option A:	Pressure head & kinetic head
Option B:	Kinetic head & datum head
Option C:	Pressure head, kinetic head & datum head
Option D:	Pressure head & datum head
5	A flat plate 1.5 m x 1.5 m moves at 50km/hour in stationary air of density 1.15kg/m3. If the co-efficient of drag and lift are 0.15 and 0.75, respectively, what are the values of: 1]. The lift force, 2]. The drag force.
Option A:	187.20N, 37.44N respectively
Option B:	165.23N, 54.23N respectively
Option C:	123.87N, 76.21N respectively
Option D:	398.67N, 45.98N respectively
6.	Euler's number is the ratio of

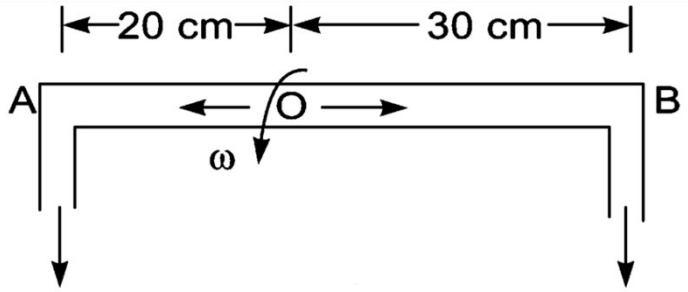
Option A:	Inertia force to pressure force
Option B:	Inertia force to elastic force
Option C:	Inertia force to gravity force
Option D:	Inertia force to Surface Tension force
7	What is the reason of providing Surge tank?
Option A:	To provide additional Tank
Option B:	To avoid water hammer
Option C:	To facilitate the discharge in the pipe
Option D:	To measure water pressure
8.	Boundary layer thickness is the distance from the surface of the solid body in the direction perpendicular to flow, where the velocity of fluid is equal to
Option A:	Free stream velocity
Option B:	0.9 times the free stream velocity
Option C:	0.99 times the free stream velocity
Option D:	0.5 times the free stream velocity
9	In a 1:100 scale model of a harbor, the time which will correspond to the prototype tidal period of 12 hours will be..
Option A:	0.12 hrs
Option B:	12 hrs
Option C:	1.2 hrs
Option D:	120 hrs
10	A ship model of scale 1/30 is towed through sea water at a speed of 1m/s. A force of 1.5 N is required to tow the model. Determine the speed of ship and the propulsive force on the ship, if prototype is subjected to wave resistance only.
Option A:	5.47 m/s, 1350 N
Option B:	7.07 m/s, 40500 N
Option C:	7.07 m/s, 1350 N
Option D:	5.47 m/s, 40500 N
11	The separation of boundary layer takes place in case of
Option A:	Negative pressure gradient
Option B:	Positive pressure gradient
Option C:	Zero pressure gradient
Option D:	Positive velocity gradient
12	The velocity distribution in laminar flow through a circular pipe follow the
Option A:	Parabolic law
Option B:	Linear law
Option C:	Logarithmic law
Option D:	Non-linear law
13	Kinematic Similarity between model & prototype means
Option A:	The similarity of forces
Option B:	The similarity of shape
Option C:	The similarity of motion
Option D:	The similarity of discharge

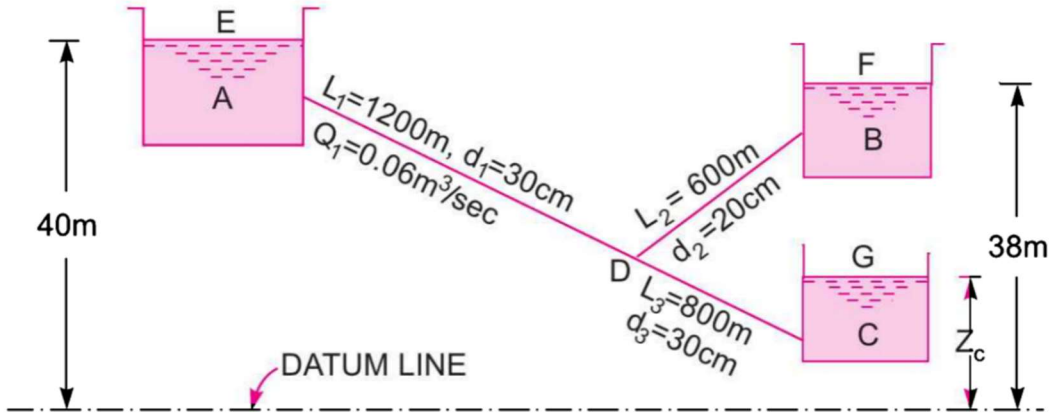
14	A pipe-line carrying water has an average height of irregularities projecting from the surface of the boundary of the pipe as 0.15mm. The shear stress developed is 4.9 N/m2. The kinematic viscosity of water is 0.01 stokes. What type of boundary is it?
Option A:	Transitional
Option B:	Smooth
Option C:	Rough
Option D:	Mixed
15	What is the name of the given equation $\frac{p_1 - p_2}{\rho g} = h_f = \frac{32\mu \bar{u} L}{\rho g D^2}$
Option A:	Euler's equation
Option B:	Bernoulli's equation
Option C:	Navier Stokes equation
Option D:	Hagen Poisueilli's equation
16	Power transmitted through pipes, will be maximum when
Option A:	The head lost due to friction is equal to half of total head at inlet of the pipe
Option B:	Head lost due to friction is one fourth of total head at inlet of the pipe
Option C:	Head lost due to friction is equal to total head at the inlet of the pipe
Option D:	Head lost due to friction is one third of total head at the inlet of the pipe
17	An incompressible fluid flows over a flat plate with zero pressure gradient. The boundary layer thickness is 1 mm at a location where the Reynolds number is1000. If the velocity of the fluid alone is increased by a factor of 4,then the boundary layer thickness at the same location, in mm will be
Option A:	1
Option B:	2
Option C:	0.5
Option D:	0.25
18	Terminal velocity of the falling body is equal to
Option A:	A maximum velocity with which the body will fall
Option B:	The maximum constant velocity with which the body will fall
Option C:	Half of the maximum velocity
Option D:	Inversely proportional to the maximum veocity
19	At the point of boundary layer separation
Option A:	shear stress is maximum
Option B:	shear stress is zero
Option C:	velocity is negative
Option D:	density variation is maximum
20	The power transmitted through a pipe is maximum when hf = H/3, and corresponding efficiency is equal to_____
Option A:	66.67%
Option B:	50%
Option C:	100%

Option D:	33.33%
21	Power transmitted by the nozzle will be maximum when head lost due to friction is equal to _____ of total head at inlet of the pipe.
Option A:	One-fifth
Option B:	Half
Option C:	One-third
Option D:	One-fourth
22	Under what condition separation flow takes place?
Option A:	du/dy < 0
Option B:	du/dy > 0
Option C:	du/dy = 0
Option D:	Not a function of du/dy
23	What is the ratio of Maximum velocity and the average velocity for a laminar flow between two parallel plates when both plates are at rest?
Option A:	0.50
Option B:	0.67
Option C:	1.50
Option D:	2.50
24	Oil of viscosity 9.81 poise flow between two plates 4 cm apart. If the difference of pressure between two section 100 cm apart be 245 kPa. The rate of flow between the two plates in the width of 10 cm is.
Option A:	67 Lps
Option B:	100 Lps
Option C:	200 Lps
Option D:	133 Lps
25	The eddy viscosity for turbulent flow is
Option A:	a function of temperature only
Option B:	a physical property of the fluid
Option C:	dependent on the flow
Option D:	independent of the flow
26	When the axis of the body is parallel to the direction of the fluid flow,
Option A:	Drag force is zero
Option B:	Lift force is maximum
Option C:	Lift force is zero
Option D:	Drag force is maximum
27	When Reynold's Number is 4023, the flow is:
Option A:	Transitional
Option B:	Laminar
Option C:	Turbulent
Option D:	Mixed

28	Oil flows through a 200 mm diameter horizontal cast iron pipe (friction factor, f = 0.0225) of length500 m. The volumetric flow rate is0.2 m^3/s. The head loss (in m) due to friction is_____ (assume g = 9.81 m/s^2)
Option A:	0.116
Option B:	116.18
Option C:	18.22
Option D:	232.36
29	In Total Head or Energy formula what does "Z" stands for $TE = p/w + Z + v^2/2g$
Option A:	Datum Head
Option B:	Velocity Head
Option C:	Pressure Head
Option D:	Total Head
30	Hydraulic Gradient Line is:
Option A:	equal to total head minus kinetic head
Option B:	equal to total head plus kinetic head
Option C:	equal to kinetic head plus datum head
Option D:	equal to pressure head plus kinetic head
31	Which property of the fluid accounts for the major losses in pipes?
Option A:	Density
Option B:	Specific Gravity
Option C:	Compressibility
Option D:	Viscosity
32	Lift force is defined as the force exerted by a flowing fluid on a solid body
Option A:	In the direction of flow
Option B:	Perpendicular to the direction of flow
Option C:	At an angle of 45 degree to the direction of flow
Option D:	Not related to direction of flow

Subjective questions (10 marks each) for Q No 2,3 and 4

1	A horizontal pipeline 40m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25m of its length from the tank, the pipe is 150mm diameter and its diameter is suddenly enlarged to 300mm. The height of water level in the tank 10m above the center of the pipe. Considering all losses of head which occur, determine the rate of flow. Take f = 0.01 for both sections of the pipe. Draw HGL and TEL
2	A lawn sprinkler with two nozzles of diameter 5mm each is connected across a tap of water as shown in the given figure. The nozzles are at a distance of 30cm and 20cm from the center of the tap. The rate of flow of water through tap is 120cm^3/s. The nozzles discharge water in the downward direction. Determine the angular speed at which the sprinkler will rotate free. 
3	A lubricating oil of viscosity 1 poise and specific gravity 0.9 laminar flow through Circular pipe of 30 mm diameter. If the pressures drop per metre length of pipe is 20 KN/m.^{2}. Determine: 1) The shear stress at the pipe wall 2) The mass flow rate in kg/min 3) The Reynold number of flow 4) the power required per 50 m length of the pipe to maintain the flow
4	A man weighing 100 kgf descends to the ground from an aeroplane with the help of a parachute against the resistance of air. The velocity with which the parachute, which is hemispherical in shape, comes down is 25m/s. Find the diameter of the parachute. Assume C_D= 0.5 and density of air = 1.25 kg/m^3.
5	A pipe bend tapers from a diameter of 500 mm at inlet to a diameter of 250 mm at outlet and turn the flow through 45°. The pressure at inlet & outlet are 3.92 N/cm^2 & 2.26 N/cm^2. If the pipe conveying oil of specific gravity 0.85, calculate the magnitude & direction of the resultant force on the bend when the oil flow rate is 0.45 m^3/s
6	A rough pipe is of diameter 8.0 cm. The velocity at a point 3.0 cm from wall is 30% more than the velocity at a point 1 cm from pipe wall. Determine the average height of the roughness.
7	A straight 25 cm pipeline 5 km long is laid between two reservoirs having a difference in level of 40 m. To increase the capacity of the system an additional 2.5 km long 25 cm pipe is laid parallel from the first reservoir to the midpoint of the original pipe. Assuming f = 0.025 for both the pipes, find the increase in discharge due to installation of the new pipe
8	A syphon of diameter 200 mm connects two reservoirs having a difference in elevation of 12 m. The total length of siphon is 600 m and the summit is 4 m above the water level in the upper reservoir. If the separation takes place at 2.8 m of water absolute. Find the maximum length of siphon from upper reservoir to the summit. Take f = 0.004 and atmospheric pressure as 10.3 m of water

9	Derive on the basis of dimensional analysis suitable parameters to present the trust developed by a propeller. Assume that the thrust developed by a propeller. Assume that the thrust P depends upon the angular velocity ω, speed of advance V, diameter D, dynamic viscosity μ, mass density ρ, elasticity of the fluid medium which can be denoted by the speed of sound in the medium C
10	Experiments were conducted in a wind tunnel with a wind speed of 60 kmph on a flat plate of size 2 m long and 1 m wide. The density of air is 1.15 kg/m^3. The coefficient of lift and drag 0.75 and 0.15 respectively. Determine i) lift force ii) drag force iii) resultant force iv) direction of resultant power v) power exerted by air on plate.
11	Explain & derive the expression for Momentum Thickness & Energy Thickness
12	Find the displacement thickness, momentum thickness and energy thickness for the velocity distribution given by $\frac{u}{U} = (\frac{y}{\delta})^{1/m}$
13	For a laminar flow through circular pipe, prove that the ratio of maximum velocity to the average velocity is equal to 2.
14	Three reservoirs A, B and C are connected by a pipe system as shown in the following figure. Find the discharge into or from reservoir B and C if the rate of flow from reservoir A is 60 liters/s. Find the height of water level in the reservoir C. Take f = 0.006 for all pipes. 
15	Two reservoirs are connected by a pipeline consisting of two pipes, one of 15 cm diameter and length 6m and the other of diameter 22.5 cm and 16 m length. If the difference of water level in the two reservoirs is 6m, calculate the discharge and draw the HGL & TEL. Take f = 0.04.

Subjective questions (5 marks each) for Q No 2,3 and 4

1	A pipe line, 60 cm diameter conveying oil (Sp. Gr. = 0.85) at the flow rate 1800 lit/s has a 90º bend in the horizontal plan. The pressure at the entrance to the bend is 1471 bar and the loss of head in the bend is 2 m of oil.Find the magnitude and direction of the force exerted by the oil on the bend and show the direction of the force on a sketch of the bend.
2	Define Laminar boundary layer, Turbulent boundary layer and Laminar sub-layer.
3	Explain different steps in solving distribution network by Hardy Cross method
4	Explain Hydro dynamically rough and smooth boundary
5	Explain water hammer with control measures.
6	In a wind tunnel the speed of the wind is 60 km/h on a flat plate of size 2.5 m long and 1.5 m wide. The density of air is 1.17 kg/m^3. The coefficient of lift and drag is 0.8 and 0.14. find (i) lift force, (ii) drag force (iii) power
7	Show that the pressure rise due to sudden closure of valve at the end of pipe, through which water is flowing is given by $p = \sqrt{\frac{d}{\frac{1}{k}+\frac{D}{Et}}}$
8	What are different empirical theories to determine the magnitude of turbulent stresses? Explain briefly anyone
9	What do you mean by Critical velocity? What is its significance?
10	What do you mean by equivalent pipe? Derive Dupit's equation for equivalent pipe.
11	What do you mean by hydrodynamically smooth and rough pipes?
12	Write a short note on Prandtl Mixing theory.
13	Write Briefly about Buckingham л- Method.
14	Write briefly about Euler's model and Mach model law.
15	Write briefly about Hydraulic and total gradient line with neat diagram indicating important point