

Laxminarayan Institute of Technology, Nagpur

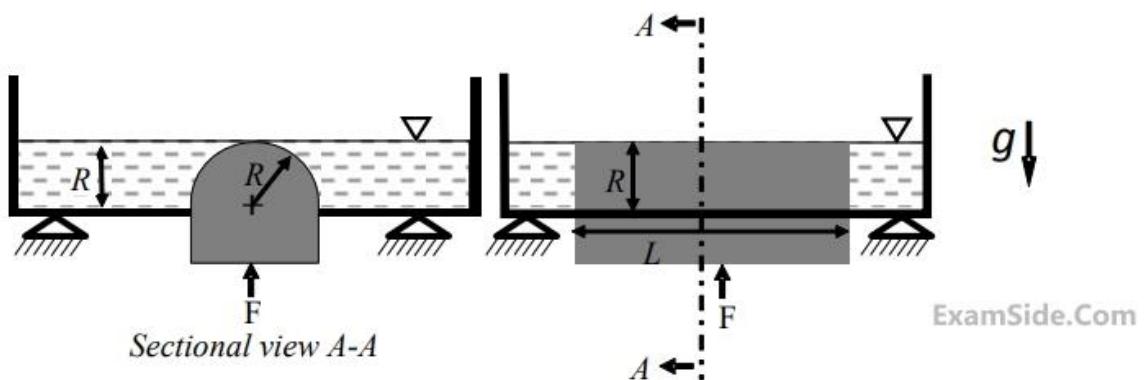
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Subject: Fluid Mechanics Question Samples (4th Sem B.Tech CE/CT)

- 1) For a floating body, buoyant force acts at the
 - A) centroid of the floating body
 - B) center of gravity of the body
 - C) centroid of the fluid vertically below the body
 - D) centroid of the displaced fluid

- 2) For a completely submerged body with center of gravity 'G' and center of buoyancy 'B', the condition of stability will be
 - A) G is located below B
 - B) G is located above B
 - C) G and B are coincident
 - D) Independent of the locations of G and B

- 3) Consider a frictionless, massless and leak-proof plug blocking a rectangular hole of dimensions $2R \times L$ at the bottom of an open tank as shown in the figure. The head of the plug has the shape of a semi-cylinder of radius R. The tank is filled with a liquid of density ρ up to the tip of the plug. The gravitational acceleration is g . Neglect the effect of the atmospheric pressure.



The force F required to hold the plug in its position is

A) $2\rho R^2 g L(1-\pi/4)$

B) $2\rho R^2 g L(1+\pi/4)$

C) $\pi R^2 \rho g L$

D) $\pi/2 \rho R^2 g L$

4) Assuming constant temperature condition and air to be an ideal gas, the variation in atmospheric pressure with height calculated from fluid statics is

A)linear

B)exponential

C)quadratic

D)cubic

5) The difference in pressure (in N/m²) across an air bubble of diameter 0.001 m immersed in water (surface tension =0.072 N/m) is _____.

A)278

B)287

C)298

D)232

6) For a Newtonian fluid:

A)shear stress is proportional to shear strain

B)rate of shear stress is proportional to shear strain

C)shear stress is proportional to rate of shear strain

D)rate of shear stress is proportional to rate of shear strain

7) An incompressible fluid (kinematic viscosity = 7.4×10^{-7} m²/s, specific gravity, 0.88) is held between two parallel plates. If the top plate is moved with a velocity of 0.5 m/s while the bottom one is held stationary, the fluid attains a linear velocity profile in the gap of 0.5 mm between

these plates; the shear stress in **Pascal** on the surface of bottom plate is :

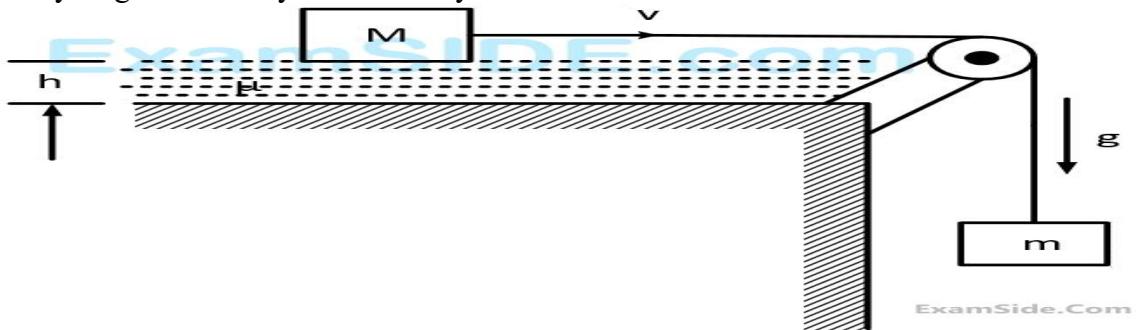
A)65.1

B)0.651

C)6.51

D)651

8) A cubic block of side 'L' and mass 'M' is dragged over an oil film across table by a string connects to a hanging block of mass 'm' as shown in fig. The Newtonian oil film of thickness 'h' has dynamic viscosity ' μ ' and the flow condition is laminar. The acceleration due to gravity is 'g'. The steady state velocity 'v' of block is :



A) $\frac{Mgh}{\mu L^2}$

B) $\frac{Mgh}{\mu}$

C) $\frac{mgh}{\mu}$

D) $\frac{Mgh}{\mu L^2}$

9) The SI unit of kinematic viscosity (ν) is :

A) m^2/sec

B) $\text{kg}/\text{m}\cdot\text{sec}$

C) m/sec^2

D) m^3/sec^2

10) Kinematic viscosity of air at 200C is given to be $1.6 \times 10^{-5} \text{ m}^2/\text{sec}$. Its kinematic viscosity at 700C will be varying approximately :

A) $2.2 \times 10^{-5} \text{ m}^2/\text{sec}$

B) $1.6 \times 10^{-5} \text{ m}^2/\text{sec}$

C) $1.2 \times 10^{-5} \text{ m}^2/\text{sec}$

D) $3.2 \times 10^{-5} \text{ m}^2/\text{sec}$

11) If ' P' is the gauge pressure within a spherical droplet, then gauge pressure within a bubble of the same fluid and of same size will be:

- A) $P/4$
- B) $P/2$
- C) P
- D) $2P$

12) The dimension of surface tension is :

- A) N/m^2
- B) J/m
- C) J/m^2
- D) W/m

13) Which of the following statement are TRUE, when the cavitation parameter $\sigma=0$ (how close the pressure in the liquid flow is to the vapor pressure (and, therefore, the potential for cavitation))?

- (i) The local pressure is reduced to vapor pressure.
 - (ii) Cavitation starts
 - (iii) Boiling of liquid starts
 - (iv) Cavitations stops
- A)(i),(ii) and (iv)
 - B)only (ii) and (iii)
 - C)only (i) and (iii)
 - D)(i),(ii) and (iii)

14) Consider fluid flow between two infinite horizontal plates which are parallel (the gap between them being 50 mm). The top plate is sliding parallel to the stationary bottom plate at a speed of 3 m/s. The flow between the plates is solely due to the motion of the top plate. The force per unit area (magnitude) required to maintain the bottom plate stationary is

_____ N/m^2 .

Viscosity of the fluid $\mu=0.44\text{kg}/\text{m}\cdot\text{s}$ and density $\rho=888$

- A)264
- B)26.4
- C)24.6
- D)2.46

15) In a simple concentric shaft-bearing arrangement, the lubricant flows in the 2 mm gap between the shaft and the bearing. The flow may be assumed to be a plane Couette flow with zero pressure gradient.

The diameter of the shaft is 100 mm and its tangential speed is 10 m/s. The dynamic viscosity of the lubricant is 0.1 kg/m.s. The frictional resisting force (in newton) per 100 mm length of the bearing is

-
- A)15.707
 - B)17.707
 - C)157.07
 - D)177.07

16) Oil in a hydraulic cylinder is compressed from an initial volume 2m^3 to 1.96m^3 . If the pressure of oil in the cylinder changes from 40 MPa to 80 MPa during compression, the bulk modulus of elasticity of oil is

- A)1000 MPa
- B)2000 MPa
- C)4000 MPa
- D)8000 MPa

17) Newton's law of viscosity states that the shear stress in a fluid is proportional to :

- A)The velocity of the fluid.
- B)The time rate of change of velocity of the fluid.
- C)The rate of change of velocity of the fluid with the height of fluid film.
- D)The square of the velocity of the fluid.

18) For steady flow of a viscous incompressible fluid through a circular pipe of constant diameter, the average velocity in the fully developed region is constant. Which one of the following statements about the average velocity in the developing region is TRUE?

- A)It increases until the flow is fully developed.
- B)It is constant and is equal to the average velocity in the fully developed region.
- C)It decreases until the flow is fully developed.
- D)It is constant but always lower than the average velocity in the fully developed region.

19) Consider a laminar flow at zero over a flat plate . The shear stress at the wall is denoted by τ_w . The axial positions x_1 and x_2 on the plate are measured from the leading edge in the direction of flow. If $x_2 > x_1$, then

- A) $\tau_w|x_1 = \tau_w|x_2 = 0$
- B) $\tau_w|x_1 = \tau_w|x_2 \neq 0$
- C) $\tau_w|x_1 > \tau_w|x_2$
- D) $\tau_w|x_1 < \tau_w|x_2$

20) Three parallel pipes connected at the two ends have flow-rates Q_1, Q_2 , and Q_3 respectively, and the corresponding frictional head losses are hL_1, hL_2 , and hL_3 respectively. The correct expressions for total flow rate (Q) and frictional head loss across the two ends (hL) are.

- A) $Q = Q_1 + Q_2 + Q_3; hL = hL_1 + hL_2 + hL_3$
- B) $Q = Q_1 + Q_2 + Q_3; hL = hL_1 = hL_2 = hL_3$
- C) $Q = Q_1 = Q_2 = Q_3; hL = hL_1 + hL_2 + hL_3$
- D) $Q = Q_1 = Q_2 = Q_3; hL = hL_1 = hL_2 = hL_3$

21) Consider fully developed flow in a circular pipe with negligible entrance length effects. Assuming the mass flow rate, density and friction factor to be constant, if the length of the pipe is doubled and the diameter is halved, the head loss due to friction will increase by a factor of

- A) 4
- B) 16
- C) 32
- D) 64

22) In fully developed laminar flow in the circular pipe, the head loss due to friction is directly proportional to (Mean velocity/square of the mean velocity)

- A) ρ
- B) V^2
- C) $\frac{1}{V}$
- D) V

23) For a fully developed laminar flow through a pipe, the ratio of the maximum velocity to the average velocity is _____

- A) Half
- B) Twice
- C) Thrice
- D) One fourth

24) The head loss for a laminar incompressible flow through a horizontal circular pipe is h_1 . Pipe length and fluid remaining the same, if the average flow velocity doubles and the pipe diameter reduces to half its previous value, the head loss is h_2 . The ratio h_2/h_1 is

- A) 1
- B) 4
- C) 8
- D) 16

25) For a fully developed laminar flow of water (dynamic viscosity 0.001 Pa-s) through a pipe of radius 5 cm, the axial pressure gradient is -10 Pa/m. The magnitude of axial velocity (in m/s) at a radial location of 0.2 cm is _____

- A) 6.2
- B) 8.2
- C) 62
- D) 82

26) For a fully developed flow of water in a pipe having diameter 10 cm, velocity 0.1 m/s and kinematic viscosity 10^{-5} m²/s, the value of Darcy friction factor is _____

- A) 0.6
- B) 0.06
- C) 6
- D) 0.006

27) Water flows through a 10 mm diameter and 250 m long smooth pipe at an average velocity of 0.1 m/s. The density and the viscosity of water are 997 kg/m³ and 855×10^{-6} N.s/m², respectively. Assuming fully-developed flow, the pressure drop (in Pa) in the pipe is _____

- A) between 600 and 700

- B) between **800** and **900**
- C) between **7800** and **7900**
- D) between 6800 & 6900

28) For laminar flow through a long pipe, the pressure drop per unit length increases.

- A) in linear proportion to the cross-sectional area
- B) in proportion to the diameter of the pipe
- C) in inverse proportion to the cross-sectional area
- D) in inverse proportion to the square of cross-sectional area

29) Navier Stoke's equation represents the conservation of

- A) Energy
- B) Mass
- C) Pressure
- D) Momentum

30) Consider the turbulent flow of a fluid through a circular pipe of diameter, D. Identify the correct pair of statements.

- I. The fluid is well-mixed
 - II. The fluid is unmixed
 - III. $ReD < 2300$
 - IV. $ReD > 2300$
- A) I, III
 - B) II, IV
 - C) II, III
 - D) I, IV

31) Consider steady laminar incompressible axi-symmetric fully developed viscous flow through a straight circular pipe of constant cross - sectional area at a Reynolds number of 5. The ratio of inertia force to viscous force on a fluid particle is

- A) 5
- B) 15
- C) 0
- D) ∞

32) Oil flows through a 200mm diameter horizontal cast iron pipe (friction factor, $f=0.0225$) of length 500m. The volumetric flow rate is 0.2m³/s. The head loss (in m) due to friction is

(assume $g=9.81 \text{ m/s}^2$)

- A) 116.18
- B) 0.116
- C) 18.22
- D) 232.36

33) The parameters which determines the friction factor for turbulent flow in a rough pipe are:

- A) Froude number and relative roughness
- B) Froude number and Mach number
- C) Reynolds number and relative roughness.
- D) Mach number and relative roughness

34) Prandtl's mixing length is turbulent flow signifies

- A) the average distance perpendicular to the mean flow covered by the mixing particles.
- B) the ratio of mean free path to characteristic length of the flow field
- C) the wavelength corresponding to the lowest frequency present in the flow field
- D) the magnitude of turbulent kinetic energy.

35) In a static fluid _____

- A) Resistance to shear stress is small
- B) Fluid pressure is small
- C) Linear deformation is small
- D) Only normal stress can exist

36) A flow field which has only convective acceleration is

- A) a steady uniform flow
- B) an unsteady uniform flow
- C) a steady non-uniform flow

D)an unsteady non-uniform flow

37) For an incompressible flow field , \vec{v} , which one of the following conditions must be satisfied?

- A) $\nabla \cdot \vec{v} = 0$
- B) $\nabla \times \vec{v} = 0$
- C) $(\vec{v} \cdot \nabla) \vec{v} = 0$
- D) $\frac{\partial \vec{v}}{\partial t} + (\vec{v} \cdot \nabla) \vec{v} = 0$

38) A streamline and an equipotential line in a flow field

- A)are parallel to each other
- B)are perpendicular to each other
- C)intersect at an acute angle
- D)are identical

39) For a continuity equation given $\nabla \cdot V = 0$ to be valid, V where is the velocity vector, which

one of the following is a necessary condition ?

- A)Steady flow
- B)Irrotational flow
- C)Inviscid flow
- D>Incompressible flow

40) Existence of velocity potential implies that

- A)Fluid is in continuum
- B)Fluid is irrotational
- C)Fluid is ideal
- D)Fluid is compressible

41) In a two-dimensional velocity field with velocities u and v along x and y directions respectively, the convective acceleration along the x -direction is given by

- A) $u \frac{\partial u}{\partial x} + v \frac{\partial u}{\partial y}$
 B) $u \frac{\partial u}{\partial x} + v \frac{\partial v}{\partial y}$
 C) $u \frac{\partial v}{\partial x} + v \frac{\partial u}{\partial y}$
 D) $v \frac{\partial u}{\partial x} + u \frac{\partial u}{\partial y}$

42) The velocity components in the x and y directions of a two dimensional potential flow are u and v , respectively. Then $\frac{\partial u}{\partial y}$ is equal to

- A) $\frac{\partial v}{\partial x}$
 B) $-\frac{\partial v}{\partial x}$
 C) $\frac{\partial v}{\partial y}$
 D) $-\frac{\partial v}{\partial y}$

43) A fluid flow is represented by the velocity field $\vec{v} = ay\vec{i} + ay\vec{j}$, where a constant . The equation of stream line passing through a point (1,2) is

- A) $x-2y=0$
 B) $2x+y=0$
 C) $2x-y=0$
 D) $x+2y=0$

44)According to Bernoulli's equation for steady ideal fluid flow

- (A) Principle of conservation of mass holds
- (B) Velocity and pressure are inversely proportional
- (C) Total energy is constant throughout
- (D) The energy is constant along a streamline but may vary across streamlines

45)Bernoulli equation deals with the law of conservation of

- (A) Mass
- (B) Momentum
- (C) Energy
- (D) Work

- 46) Which of the following instruments is used to measure flow on the application of Bernoulli's theorem?
- (A) Venturimeter
 - (B) Orifice plate
 - (C) Nozzle
 - (D) All of the above
- 47) For a perfect incompressible liquid, flowing in a continuous stream, the total energy of a particle remains the same, while the particle moves from one point to another. This statement is called
- (A) Continuity equation
 - (B) Bernoulli's equation
 - (C) Pascal's law
 - (D) Archimede's Principle
- 48) The continuity equation is connected with
- (A) Open channel/pipe flow
 - (B) Compressibility of fluids
 - (C) Conservation of mass
 - (D) Steady/unsteady flow
- 49) All the terms of energy in Bernoulli's equation have dimension of
- (A) Energy
 - (B) Work
 - (C) Mass
 - (D) Length
- 50) The Bernoulli's equation is based on the assumption that
- (A) There is no loss of energy of the liquid flowing
 - (B) The velocity of flow is uniform across any cross-section of the pipe
 - (C) No force except gravity acts on the fluid
 - (D) All of the above