ACE Engineering College

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MECHANICS OF FLUIDS & HYDRAULIC MACHINES

Branch : **Mechanical** Year : **2-2**

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Objective Questions

1. What is the correct formula for absolute pressure?

a. $P_{abs} = P_{atm} - P_{gauge}$
b. $P_{abs} = P_{vacuum} - P_{atm}$
c. $P_{abs} = P_{vacuum} + P_{atm}$
d. $P_{abs} = P_{atm} + P_{gauge}$
ANS: D

2. Blood circulation through arteries is

a. a laminar flow
b. a turbulent flow
ANS: A

3. The fluid will rise in capillary when the capillary is placed in fluid, if

a. the adhesion force between molecules of fluid and tube is less than the cohesion between liquid molecules
b. the adhesion force between molecules of fluid and tube is more than the cohesion between liquid molecules
c. the adhesion force between molecules of fluid and tube is equal to the cohesion between liquid molecules
d. cannot say

ANS:B

4.Newton's law of viscosity states that

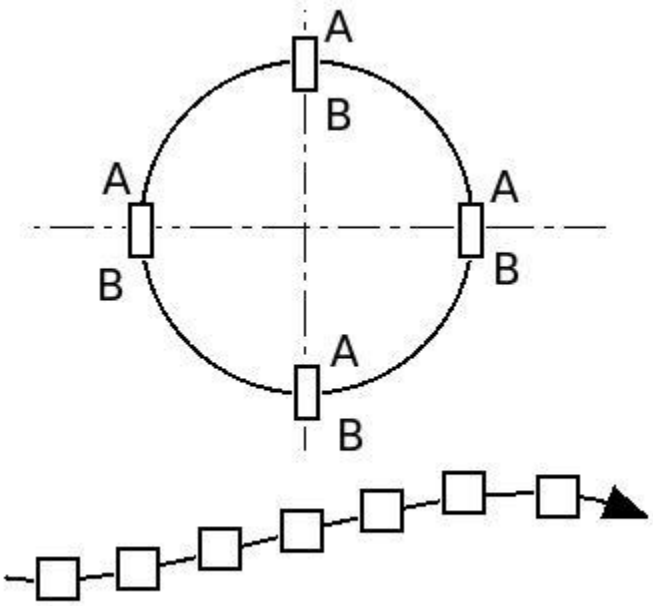
a. the shear stress applied to the fluid is directly proportional to the velocity gradient (du/dy)
b. the shear stress applied to the fluid is inversely proportional to the velocity gradient (du/dy)
c. the shear stress applied to the fluid is directly proportional to the specific weight of the fluid
d. the shear stress applied to the fluid is inversely proportional to the specific weight of the fluid

ANS:A

5.The flow of fluid will be laminar when,

a. Reynold's number is less than 2000
b. the density of the fluid is low
c. both a. and b.
d. none of the above
ANS:A

6. Which type of fluid flow is shown in below diagram?



a. Circular flow
b. Rotational flow
c. Irrotational flow
d. None of the above

ANSWER: Irrotational flow

7. The imaginary line drawn in the fluid in such a way that the tangent to any point gives the direction of motion at the point, is called as

a. path line
b. streak line
c. filament line
d. stream line

ANS: D

8. In which method of describing fluid motion, the observer remains stationary and observes changes in the fluid parameters at a particular point only?

a. Lagrangian method
b. Eulerian method
c. Stationary method
d. All of the above

ANS :B

9. Which property of the fluid offers resistance to deformation under the action of shear force?

a. density
b. viscosity
c. permeability
d. specific gravity

ANSWER: viscosity

10. Shear stress in static fluid is

a. always zero

b. always maximum
c. between zero to maximum
d. unpredictable

ANSWER: always zero

11. Calculate the magnitude of capillary effect in millimeters in a glass tube of 7mm diameter, when immersed in mercury. The temperature of the liquid is 25℃ and the values of surface tension of mercury at 25℃ are 0.51 N/m. The angle of contact for mercury is 130°.
a) 140
b) 280
c) 170
d) 210

Answer: a
Explanation: Capillarity rise or fall
$h=4*\cos\theta*\sigma/\rho*g*d$
$=4*\cos130*0.51/13600*9.81*0.007$

=140 mm.

12. Capillarity fall is reduced if we take the appartus (capillary tube immersed in fluid having acute angle of contact) considerable distance inside the earth(i.e below the earth crust).
a) True
b) False

Answer: a
Explanation: Capillary rise is given by
$h=4*\cos\theta*\sigma/\rho*g*d$
Inside the earth, g (acceleration due to gravity) decreases. Hence, capillary rise will increase compared to that on the earth's surface.

13. If a fluid of certain surface tension and diameter is used to create a soap bubble and a liquid jet. Which of the two, bubble or liquid jet, will have greater pressure difference on the inside and outside.
a) Liquid jet
b) Soap bubble
c) Both will have same pressure differrence
d) None of the mentioned

Answer: b
Explanation: For soap bubble,
$P=8*\sigma/d$
For liquid jet,
$P=2*\sigma/d$
Hence, soap bubble will be having more pressure difference.

14. 15 bar equals to _____ Pascals.
a) 10^5Pa
b) 1.5 x 10^6 Pa
c) 100 Pa
d) 1000 Pa

Answer: b
Explanation: Bar is a metric unit of pressure, but it does not fall under the SI units. One bar is exactly equal to a 100,000 Pascals. This value is taken from the atmospheric pressure on the earth at sea level.

15. The device used to measure the fluid pressure is _____
a) Hygrometer
b) Calorimeter
c) Manometer
d) Thermometer

Answer: c
Explanation: Manometer is the most preferred measuring device as the pressure is measured by difference in the column heights of the manometer. It is expressed in terms of inches or centimeters of fluid making it easier for the conversion process.

16. What is the pressure in Pascals at a depth of 1m below the water surface?
a) 98100 Pa
b) 980 Pa
c) 98 Pa
d) 1 Pa

Answer: a
Explanation: It's the summation of weights on top of the water surface. In this case, it is the weight of the atmosphere and water above 1m. [Formula: P (depth) = Patm +(density of water*gravitational constant*depth)].

18. The pressure at any given point of a non-moving fluid is called the _____
a) Gauge Pressure
b) Atmospheric Pressure
c) Differential Pressure
d) Hydrostatic Pressure

Answer: d
Explanation: Hydrostatic pressure varies with the increase in depth. Hydrostatic pressure is measured from the surface of the fluid because of the increasing weight of the fluid. The fluid exerts a downward force from the surface of water thus making it a non-moving fluid.

19. The device used to measure the surface tension is _____
a) Tensiometer
b) Calorimeter
c) Manometer
d) Thermometer

Answer: a

20 . What type of liquids is measured using a manometer?
a) Heavy liquids
b) Medium Liquids
c) Light Liquids
d) Heavy and light liquids

Answer: c
Explanation: Measurement of liquid in a manometer takes place through differential pressures by balancing the weight. Thus, it is easier for the manometer to measure liquids of lesser density than the heavier ones. Example of a light liquid is Water.

21. Which among these devices are the best suited for the measurement of high pressure liquids with high accuracy?
a) Dead Weight Gauge
b) Vacuum Gauge
c) Manganin wire pressure
d) Ionization Gauge

Answer: c
Explanation: Manganin wire is the most suitable measurement device for high pressure liquids. It has a high stability and durability on a long term basis. It also has a high hydrostatic pressure sensitivity and low strain sensitivity.

22. How do we measure the flow rate of liquid?
a) Coriolis method
b) Dead weight method
c) Conveyor method
d) Ionization method

Answer: a
Explanation: Coriolis concept of measurement of fluid takes place through the rotation with the reference frame. It is an application of the Newton's Law. The device continuously records, regulates and feeds large volume of bulk materials.

23. What is the instrument used for the automatic control scheme during the fluid flow?
a) Rota meters
b) Pulley plates
c) Rotary Piston
d) Pilot Static Tube

Answer: d
Explanation: Pilot static tube is a system that uses an automatic control scheme to detect pressure. It has several holes connected to one side of the device. These outside holes are called as a pressure transducer, which controls the automatic scheme during fluid flow.

24. Define Viscosity?
a) Resistance to flow of an object
b) Resistance to flow of air
c) Resistance to flow of fluid

d) Resistance to flow of heat
A

nswer: c
Explanation: Viscosity is developed due to the relative motion between two surfaces of fluids at different velocities. It happens due to the shear stress developed on the surface of the fluid.

25. What is the viscosity of water at 30ºC?
a) 80.1
b) 0 .801
c) 801
d) 0.081

Answer: b
Explanation: A graph is plotted with temperature in the x-axis and dynamic viscosity in the y-axis. With the increase in pressure the viscosity decreases. It corresponds to an informal concept of thickness.

26. Which one of the following is the unit of pressure?
a) N
b) N/m
c) N/m^2
d) N/m^3

Answer: c
Explanation: Pressure is defined as the force per unit area acting normal to a surface. The SI unit of force is N and area is m^2. Thus, the unit of pressure will be $N = m^2$.

27. Which one of the following is the dimension of pressure?
a) $[MLT^2]$.
b) $[MLT^{-2}]$.
c) $[ML^{-1}T^2]$.
d) $[ML^{-1}T^{-2}]$.

Answer: d
Explanation: Pressure (p) is defined as the force (F) per unit area (A) acting normal to a surface.
Thus, $$[p] = \frac{[F]}{[A]} = \frac{[MLT^{-2}]}{[L^2]} = [ML^{-1}T^{-2}]$$

28. Which one of the following statements is true regarding pressure?
a) Pressure is a scalar quantity

b) Pressure is a vector quantity
c) Pressure is a scalar quantity only when the area is infinitesimally small
d) Pressure is a vector quantity only when the area is infinitesimally small

Answer: a
Explanation: Pressure is defined as the force per unit area acting normal to a surface. Both force and area are vectors, but the division of one by the other leads to a scalar quantity.

29. A Hydraulic press has a ram of 30 cm diameter and a plunger of of 2 cm diameter. It is used for lifting a weight of 35 kN. Find the force required at the plunger.
a) 233.3 kN
b) 311.1 kN
c) 466.6 kN
d) 155.5 kN

Answer: d
Explanation: F/a=W/A
F=(35000*3.142*.02*.02)/(3.142*0.3*0.3)
=155.5 kN.

30. The pressure at a point in the fluid is 4.9 N/cm2. Find height when the fluid under consideration is in oil of specific gravity of 0.85.
a) 5.83 m
b) 11.66 m
c) 17.49 m
d) 8.74 m

Answer: a
Explanation: Height=p/ρg
=48620/850*9.81
=5.83 m.

31. An open tank contains water upto a depth of 350 cm and above it an oil of specific gravity 0.65 for a depth of 2.5 m. Find the pressure intensity at the extreme bottom of the tank.
a) 5.027 N/cm^2
b) 10.05 N/cm^2
c) 2.51 N/cm^2
d) None of the mentioned

Answer: a
Explanation: p= (specific gravity of water* height of water + specific gravity of oil* height of

oil) * 9.81
= 5.027 N/cm^2.

32. The diameters of a small piston and a large piston of a hydraulic jack are 45 mm and 100 mm respectively.Force of 0.09 kN applied on smaller in size piston. Find load lifted by piston if smaller in size piston is 40 cm above the large piston. The density of fluid is 850 kg/m3
a) 60 N/cm^2
b) 12 N/cm^2
c) 30 N/cm^2
d) None of the mentioned

Answer: a
Explanation: Pressure at bottom of tank =ρgh + F/a
=850*9.81*0.4 + 90/3.142*0.045*0.045
=60 N/cm^2.

33. If fluid is at rest in a container of a narrow mouth at a certain column height and same fluid is at rest at same column height in a container having broad mouth, will the pressure be different at certain depth from fluid surface.
a) Pressure will be same for both.
b) Pressure will be more for narrower mouth
c) Pressure will be less for narrower mouth
d) None of the mentioned

Answer: a
Explanation: As per hydrostatic law, the pressure depends only on the height of water column and not its shape.

34. Pressure intensity or force due to pressure gradient for fluid at rest is considered as which kind of force?
a) Surface force
b) Body force
c) Force due to motion
d) None of the mentioned

Answer: a
Explanation: Pressure force is surface force.

35. Calculate the hydrostatic pressure for water moving with constant velocity at a depth of 5 m from the surface.
a) 49 kN/m2
b) 98 kN/m2
c) since fluid is in motion, we cannot analyse

d) None of the mentioned

Answer: a
Explanation: If fluid is moving with uniform velocity we treat it analytically same as if fluid is at rest
$p = \rho gh$.

36. Pressure distribution for fluid at rest takes into consideration pressure due to viscous force.
a) True
b) False

Answer: b
Explanation: Viscous force term in pressure expression for fluid at rest is absent as their is no motion of liquid.

37. Barometer uses the principle of fluid at rest or pressure gradient for its pressure calculation.
a) True
b) False

Answer: a
Explanation: Principle of Barometer is Hydrostatic law.

38. The right limb of a simple U-tube manometer containing mercury is open to the atmosphere while the lift limb is connected to a pipe in which a fluid of specific gravity 0.85 is flowing. The centre of the pipe is 14 cm below the level of mercury in the right limb.Evaluate the pressure of fluid flowing in the pipe if the difference of mercury level in the two limbs is 22 cm.
a) 2.86 N/cm^2
b) 5.73 N/cm^2
c) 1.43 N/cm^2
d) None of the mentioned

Answer: a
Explanation: Pressure at centre of pipe + Pressure at depth 8 cm in left limb = Pressure at depth 22 cm in right limb
$P = 13600 \times 9.81 \times 0.22 - 850 \times 9.81 \times .08$
$= 2.86\ N/cm^2$.

39. A single coloumn manometer is connected to a pipe containing a liquid of specific gravity 0.75. Find the pressure in the pipe if the area of reservoir is 250 times the area of tube for the manometer reading. The difference in mercury level is 40 cm. On the left limb the fluid is upto the height of 20 cm.

a) 10.42 N/cm^2
b) 5.21 N/cm^2
c) 2.60 N/cm^2
d) None of the mentioned

Answer: b
Explanation: Pressure = a/A height × (density of mercury × 9.81-density of fluid × 9.81)+ height in right limb × density of mercury × 9.81 – height in left limb × density of fluid × 9.81
= 5.21 N/cm^2
{ Here a/A = 1/ 250}.

40. A Differential manometer is connected at the points A and Bat the centre of two pipes. The pipe A(left limb) contains a liquid of specific gravity = 1.5 while pipe B (right limb)contains a liquid of specific gravity 0.85. The pressure at A and B are .5 kgf/cm^2 and 1.2 kgf/cm2 respectively. Find the difference in level of mercuru in the differential manometer. A is 2.5m above B and 5 m above the mercury in its own limb. B is 2.5 m above the mercury level in limb A.
a) 12.7 cm
b) 25.5 cm
c) 6.28 cm
d) 10.85 cm

Answer: a
Explanation: Total pressure at the datum line in limb A = Total pressure at the datum line in limb B\
0.5*9.81*10000 + 5*9.81*1500 + h*9.81*13600 = 1.2*9.81*10000 + (h+2)*9.81*850
After solving,
h=12.7 cm.

41. An inverted differential manometer is connected to two pipes A and B which covey water. The fluid in manometer is oil of specific gravity 0.75. For the manometer readings, find the pressure difference between A and B. Datum in left limb is 40 cm above point A. Point B is 60 cm below datum line. Difference in level of fluid is 20 cm.
a) 1471 N/m^2
b) 2943 N/m^2
c) 735.75 N/m^2
d) None of the mentioned

Answer: a
Explanation: Total pressure at the datum line in limb A = Total pressure at the datum line in limb B
Pressure difference between A and B = -0.4*9.81*100 + 0.2*9.81*750 + 0.4*9.81*1000
= 1471 N/m^2.

42. In the inverted U-tube Differential manometer, how is the specific gravity of manometric fluid used relative to the fluid flowing in the pipes
a) Specific gravity is more than that of fluid flowing in pipes
b) Specific gravity is less than that of fluid flowing in pipes
c) Specific gravity is equal to that of fluid flowing in pipes
d) None of the mentioned

Answer: b
Explanation: In the inverted U-tube Differential manometer, specific gravity of manometric fluid used is less than relative to the fluid flowing in the pipes as the manonmetric fluid is at the top.

43. Why is large reservoir used in single column manometer?
a) In order to enhance the change in level of liquid in reservoir
b) In order to negate the effects of change in level due to pressure variation
c) In order to reduce the effect due to dynamic pressure variation due to motion
d) None of the mentioned

Answer: b
Explanation: Single column manometer directly gives the pressure by measuring the height in the other limb and due to large cross sectional area of the reservoir, for any variation in pressure, the change can be neglected.

44. Manometers are the pressure measuring devices which use the principle of dynamic pressure to measure the pressure difference.
a) True
b) False

Answer: b
Explanation: Manometers are the pressure measuring devices which use the principle of pressure due to static fluid (i.e the column height) to measure the pressure difference.

45. The distance moved by liquid will be more in which type of manometer?
a) Inclined Single coloumn manometer
b) Vertical Single coloumn manometer
c) Horizontal Single coloumn manometer
d) None of the mentioned

Answer: a
Explanation: The distance moved by liquid will be more in Inclined Single column manometer due to its inclination.

46. Differential manometer gives the pressure reading with respect to atmospheric pressure.
a) True
b) False

Answer: b
Explanation: Differential manometer gives the pressure difference between the fluid flowing in two pipes with respect to each other.

47. Which device is popularly used for measuring difference of low pressure?
a) Inverted U-tube Differential Manometer
b) U-tube Differential Manometer
c) Inclined Single column manometer
d) Vertical Single column manometer

Answer: a
Explanation: Inverted U-tube Differential Manometer has lighter manometric fluid, Hence it is used for measuring the low pressure difference.

48. Which method is used exclusively in fluid mechanics?
a) Lagrangian method
b) Eulerian method
c) Both Lagrangian and Eulerian methods
d) Neither Lagrangian nor Eulerian method

Answer: b
Explanation: In Fluid Mechanics, the matter of concern is the general state of motion at various points in the fluid system (as in Eulerian approach) rather than the motion of each particle (as in Lagrangian approach). Hence, the Eulerian method is extensively used in Fluid Mechanics

49. What type of flow can be taken for granted in a pipe of a uniform cross-section?
a) steady
b) unsteady
c) uniform
d) non-uniform

Answer: c
Explanation: According to the continuity equation, ρAV =constant, where ρ= density, A= cross-sectional area of flow, V = velocity of flow. For a pipe of a uniform cross-section, no matter what the rate of flow is, the velocity of flow inside the pipe will always remain constant. Hence,

it’ll always be a uniform flow. It’ll be a steady flow if and only if the water level is maintained at a constant level by supplying water at the same rate as it gets discharged, else the water level will keep decreasing with time leading to an unsteady flow.

50. Can the flow inside a nozzle be steady and uniform?
a) yes
b) never
c) it can be steady but never uniform
d) it can be uniform but never steady

Answer: c
Explanation: According to the continuity equation, ρAV =constant, where ρ= density, A= cross-sectional area of flow, V = velocity of flow. For a nozzle, the area gradually decreases towards it’s exit. Thus, no matter what the rate of flow is, the velocity of flow at the nozzle exit will always be greater than that at it’s entrance. Hence, it’ll always be an unsteady flow. It can be a steady flow if and only if the water level is maintained at a constant level by supplying water at the same rate as it gets discharged, else the water level will keep decreasing with time leading to an unsteady flow.