Fluid Mechanics

1. Which is the cheapest device for measuring flow / discharge rate.
a) Venturimeter
b) Pitot tube
c) Orificemeter
d) None of the mentioned

2. Which forces are neglected to obtain Euler's equation of motion from Newton's second law of motion?
a) Viscous force, Turbulence force, Compressible force
b) Gravity force, Turbulence force, Compressible force
c) Body force, Gravity force, Turbulence force
d) Viscous force, Turbulence force, Body force

3. Navier-Stoke's equation can be obtained from Reynolds's equation by not considering which type of force?
a) Turbulence force
b) Gravity force
c) Compressible force
d) Viscous force

4. In order to apply Bernoulli's equation across two sections, we have to obtain it from Euler's equation. What is the operation that needs to be carried out in order to obtain it from Euler's equation?
a) Partial Differentiation
b) Differentiation
c) Integration
d) None of the mentioned

5. Which of the following assumption is incorrect in the derivation of Bernoulli's equation?
a) The fluid is ideal
b) The flow is steady
c) The flow is incompressible
d) The flow is rotational

6. If in a fluid, while applying Newton's second law of motion, compressibility force is neglected then what equation is obtained?
a) NavierStoke's Equation
b) Reynold's equation of motion

c) Euler's Equation of motion
d) Continuity Equation for fluid flow

7. Water is flowing through a pipe of 3.8 cm diameter under a pressure of 20 N/cm^2 (gauge) and with mean velocity of 3.7 m/s. Find the total head or total energy per unit weight of the water at a cross section, which is 7 m above the datum line.
a) 56.14 m
b) 28.07 m
c) 84.18 m
d) 10.52 m

8. A fluid with specific gravity 0.85 is flowing through a diameter 250 mm and 150 mm at the bottom and upper ends respectively. Determine the difference in datum head if the rate of flow through pipe is 0.04 m^3/s. Take pressure at top and bottom as 27 N/cm^2 and 10 N/cm^2.
a) 17.1 m
b) 34.2 m
c) 10.5 m
d) None of the mentioned

9. Which instruments works based on the Bernoulli's principle

a) Pitot tube

b) Barometer

c) Flowmeters

d) Pressure switch

10. _____ is Impulse-momentum principle

a) Spinning top

b) Minimum kinetic energy

c) Collision of particles

d) Stability

11. _____ is a not conserved quantity during a process

a) Mass

b) Volume

c) Momentum

d) Energy

12. Consider air flow through a convergent duct, at inlet 1, $A_1 = 80\ cm^2$,$V_1 = 45$ m/s, $\rho_1 = 2.21$ kg/m^3 and at outlet 2, $V_2 = 150$ m/s, $\rho_2 = 0.762$ kg/m^3. Find the value of A_2

a) 69.6 m^2

b) 77 m^2

c) 50.3 m^2

d) 48.5 m^2

13. In which case, the Bernoulli's equation not valid

a) Inviscid flow

b) Irrotational flow

c) Incompressible flow

d) Heat transfer flow

14. The pressure head is

a) $P/\rho g$

b) P

c) Pg/ρ

d) P/ρ

15. The EGL is usually distance $V^2/2g$_____ the HGL

a) Equal to

b) Above

c) Below

d) None of the above

16. In an idealized Bernoulli-type flow, EGL is horizontal and its height remains _____

a) Equal to HGL

b) Constant

c) greater than HGL

d) ½ of HGL

17. Which instrument is used to measure stagnation pressure

a) Rotameter

b) Pitot tube

c) Static probe

d) Orifice

18. Euler's equation is simple form of Navier-Stokes equation with _____ term neglected.

a) Body force

b) Frictional force

c) Viscous

d) Pressure force

19. Water at 20°C is delivered from one reservoir to another through a long 8-cmdiameter pipe. The lower reservoir has a surface elevation z_2= 80 m. The friction loss in the pipe is correlated by the formula $h_{loss} \approx 17.5(V^2/2g)$, where V is the average velocity in the pipe. If the steady flow rate through the pipe is 500 gallons per minute, estimate thesurface elevation of the higher reservoir.

a) z_1= 100 m

b) z_1= 115 m

c) z_1= 85 m

d) z_1= 150 m

20. Which is not an obstruction flow meter

a) Orifice

b) Venturi

c) Manometer

d) Nozzle meters

21. Total head is _____ in the Bernoulli's equation

a) Velocity head - Pressure head

b) Constant

c) Not constant

d) None of the above

22. Static pressure P is the _____

a)Actual pressure of the fluid

b) Pressure rise when the fluid in motion is brought to a stop isentropically

c) Accounts for the effects of fluid weight on pressure

d) Pressure rise when the fluid in motion is brought to a stop non-isentropic

23. The flow rate of air moving through a square 0.50 m by 0.50 m duct is 160 m^3/ min. What is the mean velocity of the air?

a) 10.7 m/s
b) 20.5 m/s
c) 7.3 m/s
d) 25.1 m/s

24. If the velocity in a 12-inch pipe is 1.65 ft/s, what is the velocity in a 3-inch diameter jet issuing from a nozzle attached to the pipe?
a) 30.2 ft/s
b) 26.4 ft/s
c) 43.2 ft/s
d) 35.2 ft/s

26. A worker in a children's playground is cleaning a side with a hose. She observes that a horizontal stream directed into the low-end climbs to a point 12 ft above the nozzle. What is the nozzle velocity of the stream?
a) 50.2 ft/s
b) 65.2 ft/s
c) 27.8 ft/s
d) 15.3 ft/s

27. At section 1 of a pipe system carrying water the velocity is 3 fps and the diameter is 2 ft. At section 2 the diameter is 3 ft. What is the discharge value?
a) 9.42 cfs
b) 15.6 cfs
c) 23.1 cfs
d) 18.3 cfs

28. A flow rate of 0.01 m^3/s and the discharging through a 40 mm diameter nozzle. The velocity is _____
a) 23.4 m/s
b) 7.96 m/s
c) 16 m/s
d) 10.2 m/s

29. A 150 mm diameter jet of water of water is discharged from a nozzle into the air at a velocity of 36 m/s. What is the total head value with respect to a datum at the jet?
a) 58.3 m
b) 74 m
c) 43.3 m
d) 66.08 m

30. Assume a large tank with a well-rounded small opening as an outlet at the lower end. What is the velocity of a jet issuing from the tank?
a) $v_2 = \sqrt{2gh}$
b) $v_2 = \sqrt{2h}$
c) $v_2 = \sqrt{2g}$

d) $v_2 = \sqrt{2ghL}$

31. In a venture meter the converging inlet section decreases the area of the fluid stream, causing the velocity to _____ and the pressure to _____

a) decrease, increase

b) increase, decrease

c) increase, increase

d) decrease, decrease

32. In a venture meter the diverging section the pressure is _____ and the velocity is _____

a) recovered, lowered

b) constant, increase

c) lowered, recovered

d) increase, constant

33. The equation of venture meter is obtained by applying _____

a) Euler's equation

b) Navier-Stokes equation

c) Bernoulli's equation

d) None of the above

34. "Vena Contracta" is the _____ that appears just downstream of the restriction

a) maximum jet area

b) minimum jet area

c) constant jet area

d) None of the above

35. In the orifice meter, the accuracy usually

a) 1 to 2%

b) 5 to 10%

c) 2 to 4%

d) 1%

36. An orifice with a diameter $D_2 = 50$ mm, is inserted in a pipe with a diameter of $D_1 = 114$ mm. The diameter ratio is,

a) 0.49

b) 0.8

c) 0.32

d) 0.6

37. The venturi meter converging cone angle is _____

a) 5-10 deg

b) 15-20 deg

c) 12 deg

d) 3-8 deg

38. In the venturi meter, the typical accuracy is _____ of full scale

a) 5%

b) 1%

c) 7%

d) 3%

39. Given a frictionless flow of water at 125.5 ft^3/s in a long, horizontal, conical pipe of diameter 2 ft at one end and 6 ftt the other. What is the velocity at the other end?

a) 4.44 ft/s

b) 7 ft/s

c) 10.2 ft/s

d) 12.1 ft/s

40. For a free jet the maximum horizontal reach will depend on

a) the angle of projection only

b) the initial velocity only

c) the fluid flowing in the jet

d) the angle of projection and initial velocity

41. Bernoulli equation is applicable for

a) steady, rotational flow

b) steady, rotational, compressible flow

c) steady, irrotational, incompressible flow

d) unsteady, irrotational, incompressible flow

42. In a steady flow along a stream line at a location in the flow, the velocity head is 6 m, the pressure head is 3 m, the potential head is 4 m. The height of hydraulic gradient line at this location will be

a) 13 m

b) 9 m

c) 10 m

d) 7 m

43. In a flow along a varying flow cross section, as the area decreases

a) the energy line will slope up

b) the hydraulic gradient line will slope up

c) the hydraulic gradient line will slope down

d) the energy line will slope down.

44. In a steady flow of incompressible fluid, as the diameter is doubled, the velocity will

a) be halved

b) be doubled

c) increase four fold

d) decrease four fold

45. In steady flow in a varying section pipe if the diameter is doubled the kinetic energy will

a) be doubled

b) increase 4 times

c) increase 8 times

d) decrease to one sixteenth

46. In a source type of flow, the kinetic energy along the radius will vary (constant thickness of fluid along radius)
a) proportional to radius
b) directly proportional to the square root of radius
c) inversely proportional to the square of radius
d) proportional to the fourth power of radius

47. In a vertical flow of incompressible fluid along a constant pipe section under steady conditions, the pressure along flow direction will
a) remain constant
b) decrease
c) increase
d) increase or decrease depending on the fluid

48. The differential manometer connected to two points along a pipe line gives a reading of *h* in m. The flow will be
a) highest if the pipe is horizontal
b) independent of the slope of pipe and direction of flow
c) highest if flow is downwards
d) will depend on the fluid

49. Kinetic head is _____
a) $V^2/2g$
b) $V/2g$
c) $V/2$
d) $V^2/2h$

50. The assumptions involved in Euler's equation of motion
a) Steady flow
b) Motion along a stream line and
c) Ideal fluid (frictionless)
d) All of the above

51. A liquid of specific gravity 1.3 flows in a pipe at a rate of 800 *l/s*, from point 1 to point 2 which is 1 m above point 1. The diameters at section 1 and 2 are 0.6 m and 0.3 m respectively. If the pressure at section 1 is 10 *bar*, determine the pressure at section 2.
a) 12 *bar*
b) 23.21 *bar*
c) 5.602 *bar*
d) 9.092 *bar*

52. Kinetic energy of fluid element is due to its _____
a) stagnant
b) motion
c) potential difference
d) none of the above

53. Potential energy of a fluid element is due to its _____
a) stagnant
b) motion
c) **location in the gravitational field**
d) none of the above

54. Internal energy is due to majorly _____
a) the microscopic activity of atoms/molecules of the matter, exhibited by the temperature
b) the microscopic activity of atoms/molecules of the matter, exhibited by the pressure
c) the microscopic activity of atoms/molecules of the matter, exhibited by the density
d) the microscopic activity of atoms/molecules of the matter, exhibited by the velocity
55. In the analysis of incompressible fluid flow, internal energy is rarely considered because _____
a) pressure change is generally negligible
b) density change is generally negligible
c) velocity change is generally negligible
d) temperature change is generally negligible
56. Euler's equation is applicable for flow along _____
a) the streamline
b) the streamline and perpendicular to streamline
c) option a) and b) valid
d) None of the above
57. Bernoulli equation states that the total head _____
a) total head is variable
b) velocity head is constant
c) potential head is constant
d) remains constant if there are no irreversibility
58. Total head in a steady incompressible irrotational flow is the _____
a) sum of dynamic head, pressure head and potential head
b) sum of pressure head and potential head
c) dynamic head
d) none of the above
59. In steady flow along a horizontal level as the velocity increases the pressure _____
a) increase
b) constant
c) decrease
d) varies linearly
60. Energy line along the flow _____ if there are no losses
a) is constant
b) will be horizontal parallel to the flow
c) varies with velocity head
d) none of the above
61. Hydraulic grade line represents the _____along the flow
a) sum of pressure and potential head
b) sum of velocity and potential head
c) sum of pressure head only
d) sum of potential head only
62. A nozzle of 25 mm dia. directs a water jet vertically with a velocity of 12 m/s. The diameter of the jet _____
a) 45.2 mm
b) 23.4 mm

c) 38.25 mm
d) 10.9 mm
63. A nozzle of 25 mm dia. directs a water jet vertically with a velocity of 12 m/s. The velocity at a height of 6 m _____
a) 5.13 m/s
b) 10.23 m/s
c) 2.3 m/s
d) 13.5 m/s
64. The diameter of a water jet at nozzle exist is 75 mm. If the diameter at a height of 12 m is 98.7mm, when the jet is directed vertically, what is the height to which the jet will rise.
a) 23 m
b) 18 m
c) 14 m
d) 6.7 m
65. A venturimeter is used to measure liquid flow rate of 7500 litres per minute. The difference in pressure across the venturimeter is equivalent to 8 m of the flowing liquid. The pipe diameter is 19 cm. Calculate the throat diameter of the venturimeter. Assume the coefficient of discharge for the venturimeter as 0.96.
a) 12.2 cm
b) 9.9 cm
c) 3.5 cm
d) 15 cm
66. A pitot static tube is used to measure the velocity of air in a duct. The water manometer shows a reading of 8 cm. The static pressure in the duct is 9 kN/m^2 and the air temperature is 320 K. The local barometer reads 740 mm of mercury. Calculate the air velocity if $C_v = 0.98$. Assume the gas constant for air as 287 J/kg K.
a) 40.6 m/s
b) 35.85 m/s
c) 20.6 m/s
d) 16.5 m/s
67. A pitot static tube is mounted on an aircraft travelling at a speed 30 kmph against a wind velocity of 20 kmph. If the specific weight of air is 12 N/m^3 determine the pressure difference the instrument will register.
a) $h_{air} = 5032\ N/m^2$
b) $h_{air} = 326\ N/m^2$
c) $h_{air} = 632\ N/m^2$
d) $h_{air} = 509\ N/m^2$
68. The difference in mercury level of a pitot static tube connected to a submarine is 20 cm. What is the speed of the submarine. The density of sea water is 1019 kg/m_3. Assume $C_v = 0.98$.
a) 13.2 m/s
b) 6.821 m/s
c) 9.8 m/s
d) 15 m/s
69. _____ pressure loss is very low
a) orifice
b) venturi

c) flow nozzle
d) pitot tube
70. A pipe through which water is flowing, is having diameters, 20 cm and 10 cm at the cross sections 1 and 2 respectively. The velocity of the water at section 1 is 40 m/s, what is the velocity head at section 1?
a) 0.815 m
b) 0.34 m
c) 1.2 m
d) 1.56 m
71. A pipe through which water is flowing, is having diameters, 20 cm and 10 cm at the cross sections 1 and 2 respectively. The velocity of the water at section 1 is 40 m/s, what is the rate of discharge?
a) 0.356 m^3/s
b) 0.127 m^3/s
c) 0.656 m^3/s
d) 0.956 m^3/s
72. The practical applications of Bernoulli's equation
a) orifice
b) venturi
c) pitot tube
d) all of the above
73. Assume, the difference of pressure head is observed in U tube manometer is 1.6 m and take $C_v = 0.98$. What is the velocity of flow?
a) 5.49 m/s
b) 8.1 m/s
c) 10.2 m/s
d) 2.1 m/s
74. In the/ an _____ flow the Bernoulli's equation is not valid
a) steady
b) incompressible
c) frictional
d) no heat transfers
75. The potential head in the Bernoulli's equation is _____
a) *z*
b) z/p
c) p/z
d) z/H
76. The total head H - in the venture tube can be written as _____
a) p_1-p_2/ρ
b) $p_1-p_2/\rho g$
c) $p_1-p_2/\rho A_1A_2$
d) none of the above
77. A gas at 40 deg C under a pressure of 21.868 bar absolute has a unit weight of 362 N/m^3. The value of *R* for this gas?
a) 24.2 m/K
b) 10.2 m/K

c) 19.3 m/K
d) 4.3 m/K
78. Helium at 149 kPa absolute and 10 deg C is isentropically compressed to one-fourth of its original volume. The final pressure is _____
a) 1488 kPa absolute
b) 2983 kPa absolute
c) 500 kPa absolute
d) 3255 kPa absolute
79. A gasoline pump fills an 80-litre tank in 1 min 15 sec. The value of volume flow rate Q is _____
a) 0.00546 m^3/s
b) 0.000945 m^3/s
c) 0.001067 m^3/s
d) 0.0945 m^3/s
80. A gasoline pump fills an 80-litre tank in 1 min 15 sec. If the pump exit diameter is 4 cm, the average pump flow exit velocity is _____
a) 0.56 m/s
b) 0.34 m/s
c) 0.67 m/s
d) 0.85 m/s
81. If the velocity in a 12-inch pipe is 1.65 ft/s, what is the velocity in a 3-inch diameter jet issuing from a nozzle attached to the pipe?
a) 26.4 ft/s
b) 34.5 ft/s
c) 45.3 ft/s
d) 20 ft/s
82. Air at 42 deg C and at 3 bar absolute pressure flows in a conduit at a mean velocity of 12 m/s. The value of density is _____
a) 4.56 kg/m^3
b) 3.318 kg/m^3
c) 6.56 kg/m^3
d) 8.3 kg/m^3
83. Air at 42 deg C and at 3 bar absolute pressure flows in a 200 mm diameter conduit at a mean velocity of 12 m/s. The mass flow rate is _____
a) 3.4 kg/s
b) 6.2 kg/s
c) 1.25 kg/s
d) 7.1 kg/s
84. At section 1 of a pipe system carrying water the velocity is 3 fps and the diameter is 2 ft. At section 2 the diameter is 3 ft, the discharge at section 2 in the is _____
a) 4.5 cfs
b) 9.42 cfs
c) 12 cfs
d) 16 cfs
85. At section 1 of a pipe system carrying water the velocity is 3 fps and the diameter is 2 ft. At section 2 the diameter is 3 ft, the velocity at section 2 in the is _____

a) 1.33 fps
b) 3.4 fps
c) 6 fps
d) 8 fps
86. In a moving fluid, the static pressure is measured _____
a) parallel to in the direction of flow
b) at right angles to the direction of flow
c) in the opposite to the direction of flow
d) downward in the direction of flow
87. The Ideal Gas Law includes _____
a) Boyle's law only
b) Charles' law only
c) Boyle's and Charles' laws
d) none of the above
88. Chimney works best on principle of
a) equation of continuity
b) Bernoulli's equation
c) light equation
d) speed equation
89. Fundamental equation that relates pressure to fluid's speed and height is known as
a) equation of continuity
b) light equation
c) Bernoulli's equation
d) speed equation
90. Change in kinetic energy is measured as difference of
a) $1/2(mv)^2$
b) $(mv)^2$
c) $1/2(mv)$
d) $1/2(m)^2$
91. According to equation of continuity, when water falls its speed increases, while its cross-sectional area
a) increases
b) decreases
c) remain same
d) different
92. Simplified equation of continuity is represented as
a) $A_1V_1 = A_2V_2$
b) $A_1V_2 = A_2V_2$
c) $A_1V_1 = A_1V_2$
d) $A_2V_1 = A_1V_1$
93. The cylindrical portion of short length, which connects converging and diverging section of venturimeter, is called as
a) diffuser
b) connector
c) throat
d) manometer tube

94. Venturimeter consists of short converging conical tube which has a total inclination angle of _____

a) 11 ± 1^o
b) 21 ± 1^o
c) 30 ± 1^o
d) 60 ± 1^o

95. Which is the correct formula for Euler's equation of motion?
Where,
ρ = density of the fluid
p = pressure force
g = acceleration due to gravity
v = velocity of the fluid

a) $(\partial p / \rho) + (\partial g / \rho) + (\partial v / \rho) = 0$
b) $(\partial p / \rho) + (\partial g / \rho) + (v\ dv) = 0$
c) $(\partial p / \rho) + (g\ dz) + (v\ dv) = 0$
d) $(p\ dp) + (g\ dz) + (v\ dv) = 0$

96. When the net force acting on a fluid is the sum of only gravity force, pressure force and viscous force, the equation is called as
a) Reynold's equation of motion
b) Navier-stockes equation of motion
c) Euler's equation of motion
d) none of the above

97. The net force of an ideal flow is equal to the sum of nonzero values of _____
a) pressure force and gravity force
b) viscous force and gravity force
c) pressure force and viscous force
d) pressure force, viscous force and compressibility force

98. The study of force which produces motion in a fluid is called as
a) fluid statics
b) fluid dynamics
c) fluid kinematics
d) none of the above

99. A venturimeter of 20 mm throat diameter is used to measure the velocity of water in a horizontal pipe of 40 mm diameter. If the pressure difference between the pipe and throat sections is found to be 30 kPa then, neglecting frictional losses, the flow velocity is
a) 0.2 m/s
b) 1.0 m/s
c) 1.4 m/s
d) 2.0 m/s

100. Water is coming out from the tap and falls vertically downwards. At the tap opening, the stream diameter is 20 mm with uniform velocity of 2 m/s. Acceleration due to gravity is 9.81 m/s^2. Assume steady, inviscid flow, constant atmospheric pressure everywhere and neglecting curvature and surface tension effects, the diameter in mm of the stream 0.5 m below the tap is approximately,
a) 10 mm

b) 15 mm
c) 20 mm
d) 25 mm

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01. Which of the following is the dimensionally homogeneous equation?

A. $Q = A\ (2gH)^{0.5}$
B. $S = ut - 0.5\ t^2$
C. $P = wQH/1000$
D. $Q = (A2gH)^{0.5}$

ANSWER: C

02. The minimum number of fundamental units entering into any physical problem is

A. 1
B. 2
C. 3
D. 4

ANSWER: B

03. The number of fundamental dimensions in a phenomenon controlled by variables Q (flow rate), H (head), g (acceleration due to gravity), v (velocity) and W (width) is

A. 2
B. 3
C. 4
D. 5

ANSWER: A

04. Which of the following is a non-dimensional parameter

A. Q^2 / gH^5
B. V^2 / g^2Q
C. $Q / (gH)^{0.5}$
D. $Q / (2gH)^{0.5}$

ANSWER: A

05. Which term among the following represents Reynold number?

A. vL / v
B. $vL\mu / \rho$
C. $v / (gL)^{0.5}$
D. $(p_2 - p_1) / gv^2$

ANSWER: A

06. Which of the following is not dimensionless?

A. Coefficient of discharge

B. Kinematic visc0sity
C. Reynold number
D. Mach number
ANSWER: B

07. Reynold number plays an important role in
A. Flow through pipe
B. Flow through channel
C. Waves in the sea
D. Sheet flow
ANSWER: A

08. In the study of forces acting on Aeroplane flying with supersonic velocity, ---------- number plays an important role.
A. Reynold number
B. Froud number
C. Euler number
D. Mach number
ANSWER: D

09. The discharge scale ratio for Froud law is
A. $(L_r)^{2.5}$
B. $(L_r)^{3.5}$
C. $(L_r)^{0.5}$
D. $(L_r)^{3}$
ANSWER: A

10. The force scale ratio for Reynold law using the same fluid in model and prototype is
A. L_r^{2}
B. $(L_r)^{0.5}$
C. L_r^{3}
D. 1
ANSWER: D

11. The dimensions of surface tension are
A. ML^{-1}
B. MT^{-2}
C. $ML^{-1}T^{-2}$
D. $ML^{-2}T^{-1}$
ANSWER: B

12. Euler number is given by
A. (Inertia force / pressure force)$^{0.5}$
B. Inertia force / viscous force

C. (Inertia force / viscous force)$^{0.5}$
D. (Inertia force / elasticity force)$^{0.5}$
ANSWER: A

13. According to Froud law acceleration ratio is equal to
A. L_r^2
B. $1 / L_r^2$
C. 1
D. $1 / L_r$
ANSWER: C

14. Discharge ratio for Reynold law using same liquid for model and prototype is given by
A. L_r
B. L_r^3
C. 1
D. $(L_r)^{0.5}$
ANSWER: C

15. The ratio of inertia force to viscous force is known as
A. Froud number
B. Weber number
C. Reynold number
D. Mach number
ANSWER: C

16. Model analysis of pipe flow is based on
A. Reynold number
B. Froud number
C. Euler number
D. Mach number
ANSWER: A

17. Model analysis for free surface flow is based on
A. Reynold number
B. Froud number
C. Euler number
D. Mach number
ANSWER: B

18. Model analysis of a projectile moving with supersonic velocity is based on
A. Reynold number
B. Froud number
C. Euler number
D. Mach number

ANSWER: D

19. The velocity of fluid at which laminar flow changes to turbulent flow is known as

A. Linear velocity
B. Mean velocity
C. Maximum velocity
D. Critical velocity

ANSWER: D

20. If V_a is the average velocity at any section in a flow through pipe and U is the maximum velocity at that section, then the relation between them is given by

A. $V_a = (2/3)\ U$
B. $V_a = U\ /3$
C. $V_a = U\ /2$
D. $V_a = (U)^{1/3}$

ANSWER: C

21. The velocity distribution in laminar flow through a pipe follows ---------- law.

A. Parabolic
B. Logarithmic
C. Linear
D. Exponential

ANSWER: A

22. The shear stress distribution in laminar flow through a pipe follows ---------- law.

A. Parabolic
B. Logarithmic
C. Linear
D. Exponential

ANSWER: C

23. The coefficient of friction for laminar flow through a pipe is given by

A. $64\ /\ R_e$
B. $R_e\ /64$
C. $0.98\ /\ (R_e)^{0.5}$
D. $(R_e)^{0.5}\ /\ 0.98$

ANSWER: A

24. The shear stress in fluid flowing between two fixed parallel plates with small gap is

A. Maximum at the centre of gap
B. Constant over the section
C. Maximum at the plates
D. Zero at the plates

ANSWER: C

25. The velocity distribution between two fixed parallel plates for laminar flow
A. Constant at the cross section
B. Is maximum at the centre, zero at the plates and varies linearly
C. Varies parabolically across the section
D. Varies logarithmically across the section
ANSWER: C

26. The maximum velocity in a pipe when flow is laminar occurs at
A. Top of the pipe
B. Centre of the pipe
C. Bottom of the pipe
D. Somewhere at the section other than the centre
ANSWER: B

27. The shear stress in a flowing fluid through a pipe is
A. Constant over the section
B. Zero at the wall and increasing linearly to the centre
C. Zero at the centre and Varying linearly with the radius
D. Varying parabolically across the section
ANSWER: C

28. The pressure gradient dp/dx in case of laminar flow between two fixed horizontal parallel plates is
A. Zero
B. Positive
C. Negative
D. Can be zero, positive or negative
ANSWER: C

29. In laminar flow through a pipe, the discharge varies
A. Linearly as the velocity
B. As the square of radius
C. Inversely as the viscosity
D. Inversely as the pressure drop
ANSWER: C

30. The exact solution of viscous flow problem can be obtained from
A. Continuity equation
B. Bernoullis equation
C. Euler's equation
D. Navier Stoke equation
ANSWER: D

31. The liquid flowing through a pipe of 10m long has head loss of 2m, the Reynold number is 100 and if the flow rate is doubled, the head loss will be

A. 0.5m
B. 4m
C. 8m
D. 2m

ANSWER: B

32. If the pressure drop in 8 cm diameter and 15 m length of pipe is 75 kN /m^2, shear stress at the pipe in kN/m^2 will be

A. 0.2
B. 2
C. 4
D. 6

ANSWER: A

33. The minimum value of friction factor f in a laminar flow through a circular pipe is

A. 0.025
B. 0.032
C. 0.05
D. 0.064

ANSWER: B

34. A 20 cm diameter pipe carries an oil of density 900 kg/m^3 and if the shear stress at the pipe wall is 0.5 N/m^2, the head loss in 100 m length of pipe is

A. 11.35 m
B. 5.85 m
C. 8.6 m
D. 6.8 m

ANSWER: A

35. If the friction factor in a laminar pipe flow is found as 0.04, Reynold number will be

A. 2000
B. 1500
C. 1000
D. 1600

ANSWER: D

36. If the centre line velocity of a pipe of 12 cm diameter in a laminar flow condition is 2 m/s, the velocity at 2 cm from the axis of the pipe is

A. 0.22 m/s
B. 0.33 m/s
C. 1.66 m/s

D. 1.78 m/s
ANSWER: D

37. If the wall shear stress in a pipe of 8 cm diameter carrying a laminar flow is 28 N/m^2, the shear stress at 3 cm from the axis is
A. 74 N/m^2
B. 7 N/m^2
C. 21 N/m^2
D. 12.5 N/m^2
ANSWER: C

38. If the centre line velocity is 1.8 m/s in a laminar flow between two fixed parallel plates with a distance of 6 mm, the velocity at 1 mm from the plate surface is
A. 0.15 m/s
B. 1.5 m/s
C. 1 m/s
D. 0.75 m/s
ANSWER: C

39. If a fluid of density 900 kg/m^3, dynamic viscosity 1.2 Ns/m^2 flows through two fixed parallel plates 3 cm apart with a discharge of 216 m^3/s per meter width of the plate, the shear stress at the boundary in N/m^2 is
A. 480
B. 840
C. 800
D. 400
ANSWER: A

40. If in a laminar flow of liquid down an inclined plane, the surface velocity is 0.3 m/s, the average velocity of the flow in m/s is
A. 0.2
B. 0.225
C. 0.15
D. 0.1
ANSWER:

41. The shear stress in a turbulent flow through pipe is
A. Maximum at the centre and decreases linearly towards wall
B. Maximum at the wall and decreases linearly to zero at the centre
C. Maximum at the centre and decreases logarithmically towards the wall
D. Maximum at the wall and decreases logarithmically at the centre
ANSWER: B

42. In a fully turbulent pipe flow, the velocity distribution in laminar sub layer will be

A. Parabolic
B. Logarithmic
C. Linear
D. Exponential
ANSWER: C

43. In a turbulent flow through a pipe, the ratio of maximum velocity U to mean velocity V_a is
A. 3.75
B. 2
C. 1.5
D. 3
ANSWER: A

44. Within the boundary layer, the pressure
A. Remains constant and has the same value as that at the edge of the boundary
B. Is atmospheric
C. Varies linearly with the thickness of the boundary layer
D. Is same as the approaching flow
ANSWER: A

45. In a fluid stream of small viscosity
A. The viscosity has no appreciable effect on the drag-force around the body placed in it
B. There is a small region surrounding the body in which the effect of viscosity is predominant
C. The flow pattern around the body is not much affected
D. There is a small region surrounding the body in which the effect of viscosity is zero
ANSWER: B

46. The local thickness of laminar boundary layer varies as
A. $(x)^{4/3}$
B. $(x)^{1/2}$
C. $(x)^{-1/2}$
D. $(x)^{1/7}$
ANSWER: B

47. The local thickness of turbulent boundary layer varies as
A. $(x)^{4/3}$
B. $(x)^{1/2}$
C. $(x)^{-1/2}$
D. $(x)^{1/7}$
ANSWER: D

48. The average drag coefficient or turbulent boundary layer over a flat plate (when $R_e = 10^7$) is based on
A. Parabolic velocity distribution in boundary layer

B. Logarithmic velocity distribution in boundary layer
C. Linear velocity distribution in boundary layer
D. One-seventh power law of velocity distribution in boundary layer
ANSWER: D

49. Boundary layer separation is caused by
A. Reducing the pressure to vapour pressure
B. Reducing the pressure gradient to zero
C. Accelerating the flow
D. Positive pressure gradient
ANSWER: D

50. The growth of boundary layerwhen the flow takes place over a smooth flat plate
A. Decreases with an increase in kinematic viscosity when boundary flow is laminar only
B. Decreases with an increase in free stream velocity if the boundary layer is laminar only
C. Increases with an increase in kinematic viscosity in both laminar and turbulent boundary layers
D. Increases with increase in free stream velocity
ANSWER: C

51. The rate of growth of boundary layer thickness on a flat plate along the flow direction
A. Is faster in laminar boundary layer than in turbulent boundary layer
B. Is faster in turbulent boundary layer than in laminar boundary layer
C. Is same whether the flow in boundary layer is laminar or turbulent
D. Is zero
ANSWER: B

52. The head loss due to friction is governed by
A. Froude's law
B. Chezy's law
C. Darcy's law
D. Reynold's law
ANSWER: A

53. The velocity of flow through a pipeline according to Chezy's formula is given by
A. Velocity = m $(Ci)^{0.5}$
B. Velocity = I $(mC)^{0.5}$
C. Velocity = (1/e) $(mi)^{0.5}$
D. Velocity = C $(mi)^{0.5}$
ANSWER: D

54. If the velocity v_1 changes to v_2 in a pipe when the diameter d_2 suddenly changes to d_2 ($d_2 > d_1$), then the loss of head is given by
A. $(v_1^{\,2} - v_2^{\,2}) / 2g$
B. $2(v_1 - v_2) / g$

C. $(v_1 - v_2)^2 /2g$
D. $(v_1 - v_2) /2g$
ANSWER: C

55. The head loss due to sudden contraction in a pipe line is given as K $v^2/2g$ where K is
A. $((1/C_c)-1)^2$
B. $((1/C_c)-1)$
C. $1 - (1/C_c)$
D. $(1/C_c^2)-1$
ANSWER: A

56. In a uniform diameter of pipeline, the loss of head at exit is
A. One half that at inlet
B. Same that at inlet
C. Twice that at inlet
D. Four times that at inlet
ANSWER: C

57. The HGL is
A. Sometimes above TEL
B. Velocity head below TEL
C. Velocity head above TEL
D. At TEL
ANSWER: B

58. HGL for horizontal pipeline of uniform diameter is a
A. Straight line parallel to the axis of the pipeline
B. Straight line gradually sloping downwards towards the direction of flow
C. Curved line sloping towards the direction of flow
D. Straight vertical line
ANSWER: B

59. The head loss in sudden expansion from 6 m diameter to 12 cm diameter pipe is given by
A. $(15/16)v_1^2$
B. $0.75 (v_1^2/2g)$
C. $0.25 (v_1^2/2g)$
D. $99/16) (v_1^2/2g)$
ANSWER: D

60. If in a sudden contraction, the velocity head changes from 0.5 m to 1.25 m, the coefficient of contraction is 0.67, the head loss due to contraction is
A. 0.133 m
B. 0.332 m
C. 0.644 m

D. 0.266 m
ANSWER: B

61. The HGL represents the sum of
A. Pressure head and kinetic head
B. Kinetic head and datum head
C. Pressure head and datum head
D. Pressure head, kinetic head and datum head
ANSWER: C

62. The TEL represents the sum of
A. Pressure head and kinetic head
B. Kinetic head and datum head
C. Pressure head and datum head
D. Pressure head, kinetic head and datum head
ANSWER: D

63. When two pipes are arranged in series
A. The flow rate may be different in the two pipes
B. The head loss per unit length must be more in the smaller pipe
C. The velocity of flow must be same in the two pipes
D. The head loss must be same in the two pipes
ANSWER: B

64. In a parallel pipe system
A. The flow must be equal in all pipes
B. The head loss per unit length must be same for all pipes
C. The head loss across each of parallel pipes must be same
D. The head loss across each of parallel pipes must be different
ANSWER: C

65. A pipe is replaced by two parallel pipe, each with same cross sectional area which is half of the cross sectional area of the original, then the discharge will
A. Remain same
B. Increase by more than 10%
C. Decrease by more than 10%
D. Increase by 50%
ANSWER: C

66. If it is required to carry the same discharge by replacing a pipe of diameter D by two equal parallel pipes of diameter d, then (d/D) should be
A. 0.37
B. 0.42
C. 0.76

D. 0.56
ANSWER: C

67. A pipeline is said to be equivalent to another pipeline if in both
A. The length and discharge are same
B. The velocity and diameter are same
C. The discharge and pressure head loss are same
D. The length and diameter are same
ANSWER: C

68. For the pipes connected in series
A. $v = v_1 + v_2 + ...$
B. $f = f_1 + f_2 + ...$
C. $Q = Q_1 + Q_2 + ...$
D. $h_f = h_{f1} + h_{f2} + ...$
ANSWER: D

69. For the pipes connected in parallel
A. $v = v_1 + v_2 + ...$
B. $f = f_1 + f_2 + ...$
C. $Q = Q_1 + Q_2 + ...$
D. $h_f = h_{f1} + h_{f2} + ...$
ANSWER: C

70. When the pipes are connected in series, the total rate of flow is
A. Equal to sum of the flow rate in each pipe
B. Equal to sum of the reciprocal of flow rate in each pipe
C. Same as flowing through each pipe
D. Zero
ANSWER: C

71. If two identical pipes of length L, diameter d and friction factor 'f' are connected in parallel between two reservoirs, the size of pipe of length L and same friction factor 'f' equivalent to the above pipe is
A. 1.4 d
B. 0.87 d
C. 2d
D. 0.5 d
ANSWER: A

72. If two identical pipes of length L, diameter d and friction factor 'f' are connected in series between two reservoirs, the size of pipe of length L and same friction factor 'f' equivalent to the above pipe is
A. 0.5 d

B. 1.4 d
C. 1.2 d
D. 0.87 d
ANSWER: D

73. Two pipe lines of 20 cm and 30 cm diameters and of equal lengths are connected parallel between two reservoirs. If f is same for both the pipe lines, the ratio of discharge in 20 cm line to discharge in 30 cm line is
A. 0.363
B. 0.726
C. 0.1815
D. 0.555
ANSWER: A

74. Two reservoirs are connected by two pipes A and B having same length and f in series. If the diameter of A is 30% greater than that of B, then the ratio of head loss in A to that in B is
A. 74%
B. 20%
C. 43%
D. 35%
ANSWER: A

75. For maximum transmission of power through a pipe line with total head H, the head loss due to friction h_f is
A. H/3
B. H/2
C. (2/3)H
D. H/6
ANSWER: A

76. A pipe connecting two reservoirs is said to be s syphon, if
A. It can discharge liquid at fast rate
B. Its exit is at lower level than its inlet
C. It has sub atmospheric pressure in it
D. Its exit is at higher level than its inlet
ANSWER: C

77. The pressure of water at the outlet of a nozzle is
A. Atmospheric
B. Below atmospheric
C. Above atmospheric
D. Negative
ANSWER: A

01. If the number of fundamental dimensions equals 'm', then the repeating variables shall be equal to:
A. m and none of the repeating variables shall represent the dependent variable.
B. m + 1 and one of the repeating variables shall represent the dependent variable
C. m + 1 and none of the repeating variables shall represent the dependent variable.
D. m and one of the repeating variables shall represent the dependent variable.
ANSWER: C

02. The Reynolds number for flow of a certain fluid in a circular tube is specified as 2500. What will be the Reynolds number when the tube diameter is increased by 20% and the fluid velocity is decreased by 40% keeping fluid the same?
A. 1200
B. 1800
C. 3600
D. 200
ANSWER: B

03. The square root of the ratio of inertia force to gravity force is called
A. Reynolds number
B. Froude number
C. Mach number
D. Euler number
ANSWER: B

04. An aeroplane is cruising at a speed of 800 kmph at altitude, where the air temperature is 0° C. The flight Mach number at this speed is nearly
A. 1.5
B. 0.254
C. 0.67
D. 2.04
ANSWER: C

05. In flow through a pipe, the transition from laminar to turbulent flow does not depend on
A. Velocity of the fluid
B. Density of the fluid
C. Diameter of the pipe
D. Length of the pipe
ANSWER: D

06. The time period of a simple pendulum depends on its effective length I and the local acceleration due to gravity g. What is the number of dimensionless parameter involved?
A. Two
B. One
C. Three
D. Zero
ANSWER: B

07. In a fluid machine, the relevant parameters are volume flow rate, density, viscosity, bulk modulus, pressure difference, power consumption, rotational speed and characteristic dimension. Using the Buckingham pi (π) theorem, what would be the number of independent non-dimensional groups?
A. 3
B. 4
C. 5
D. None of the above
ANSWER: C

08. Consider the following statements:
1. Dimensional analysis is used to determine the number of variables involved in a certain phenomenon
2. The group of repeating variables in dimensional analysis should include all the fundamental units.
3. Buckingham's π theorem stipulates the number of dimensionless groups for a given phenomenon.
4. The coefficient in Chezy's equation has no dimension. Which of these are correct?
A. 1, 2, 3 and 4
B. 2, 3 and 4
C. 1 and 4
D. 2 and 3
ANSWER: D

09. Euler number is defined as the ratio of inertia force to:
A. Viscous force
B. Elastic force
C. Pressure force
D. Gravity force
ANSWER: C

10. Which one of the dimensionless numbers identifies the compressibility effect of a fluid?
A. Euler number
B. Froude number
C. Mach number
D. Weber number
ANSWER: C

11. It is observed in a flow problem that total pressure, inertia and gravity forces are important. Then, similarly requires that
A. Reynolds and Weber numbers be equal
B. Mach and Froude numbers be equal
C. Euler and Froude numbers be equal
D. Reynolds and Mach numbers be equal
ANSWER: C

12. Consider the following statements:
1. For achieving dynamic similarity in model studies on ships, Froude numbers are equated.
2. Reynolds number should be equated for studies on aerofoil for dynamic similarity.
3. In model studies on a spillway, the ratio of width to height is equated for kinematic similarity.
What of the statements given above are correct?
A. 1, 2 and 3
B. 1 and 2
C. 2 and 3
D. 1 and 3
ANSWER: D

13. Kinematic similarity between model and prototype is the similarity of
A. Shape
B. Discharge
C. Stream line pattern
D. Forces
ANSWER: C

14. Assertion (A): Reynolds number must be same for the model and prototype immersed in subsonic flows. Reason (R): Equality of Reynolds number for the model and prototype satisfies the dynamic similarity criteria.
A. Both A and R are individually true and R is the correct explanation of A
B. Both A and R are individually true but R is not the correct explanation of A
C. A is true but R is false
D. A is false but R is true
ANSWER: B

15. A model test is to be conducted in a water tunnel using a 1: 20 model of a submarine, which is to travel at a speed of 12 km/h deep under sea surface. The water temperature in the tunnel is maintained, so that is kinematic viscosity is half that of sea water. At what speed is the model test to be conducted to produce useful data for the prototype?
A. 12 km/h
B. 240 km/h
C. 24 km/h
D. 120 km/h
ANSWER: D

16. A sphere is moving in water with a velocity of 1.6 m/s. Another sphere of twice the diameter is placed in a wind tunnel and tested with air which is 750 times less dense and 60 times less viscous than water. The velocity of air that will give dynamically similar conditions is:
A. 5 m/s
B. 10 m/s
C. 20 m/s
D. 40 m/s
ANSWER: B

17. The model of a propel1er, 3 m in diameter, cruising at 10 m/s in air, is tested in a wind tunnel on a 1: 10 scale model. If a thrust of 50 N is measured on the model at 5 m/s wind speed, then the thrust on the prototype will be:
A. 20,000 N
B. 2,000 N
C. 500 N
D. 200 N
ANSWER: A

18. A 1.0 m log model of a ship is towed at a speed of 81 cm/s in a towing tank. To what speed of the ship, 64 m long does this correspond to?
A. 7.20 m/s
B. 6.48 m/s
C. 5.76 m/s
D. 3.60 m/s

ANSWER: B

19. A ship model 1/60 scale with negligible friction is tested in a towing tank at a speed of 0.6 m/s. If a force of 0.5 kg is required to tow the model, the propulsive force required to tow the prototype ship will be:
A. 5 MN
B. 3 MN
C. 1 MN
D. 0.5 MN
ANSWER: C

20. A1:256 scale model of a reservoir is drained in 4 minutes by opening the sluice gate. The time required to empty the prototype will be:
A. 128 min
B. 64 min
C. 32 min
D. 25.4 min
ANSWER: B

21. A ship whose full length is 100 m is to travel at 10 m/s. For dynamic similarity, with what velocity should a 1: 25 model of the ship be towed?
A. 2 m/s
B. 10 m/s
C. 25 m/s
D. 250 m/s
ANSWER: A

22. A $\frac{1}{2}$model of a ship is to be tested for estimating the wave drag. If the speed of the ship is 1 m/s, then the speed at which the model must be tested is:

A. 0.04 m/s
B. 0.2 m/s
C. 5.0 m/s
D. 25.0 m/s
ANSWER: B

23. In a flow condition where both viscous and gravity forces dominate and both the Froude number and the Reynolds number are the same in model and prototype; and the ratio of kinematic viscosity of model to that of the prototype is 0.0894. What is the model scale?
A. 1: 3.3
B. 3.3: 1
C. 5: 1
D. 1:5
ANSWER: C

24. A 1:20 model of a spillway dissipates 0.25 hp. The corresponding prototype horsepower dissipated will be:
A. 0.25
B. 5.00
C. 447.20
D. 8944.30
ANSWER: D

25. A ship with hull length of 100 m is to run with a speed of 10 m/s. For dynamic similarity, the velocity for a 1: 25 model of the ship in a towing tank should be:
A. 2 m/s
B. 10 m/s
C. 20 m/s
D. 25 m/s
ANSWER: A

26. A ship's model, with scale 1: 100, has a wave resistance of 10 N at its design speed. What is the corresponding prototype wave resistance in kN?
A. 100
B. 1000
C. 10000
D. Cannot be determined because of insufficient data
ANSWER: C

27. A model test is to be conducted for an underwater structure which each likely to be exposed for an underwater structure, which is likely to be exposed to strong water currents. The significant forces are known to the dependent on structure geometry, fluid velocity, fluid density and viscosity, fluid depth and acceleration due to gravity. Choose from the codes given below, which of the following numbers must match for the model with that of the prototype:

1. Mach number	2. Weber number
3. Froude number	4. Reynolds number.

A. 3 alone
B. 1, 2, 3 and 4
C. 1 and 2
D. 3 and 4
ANSWER: D

28. Consider the following statements:
1. Complete similarity between model and prototype envisages geometric and dynamic similarities only.
2. Distorted models are necessary where geometric similarity is not possible due to practical reasons.
3. In testing of model of a ship, the surface tension forces are generally neglected.
4. The scale effect takes care of the effect of dissimilarity between model and prototype.
Which of these statements are correct?
A. 1 and 3
B. 1, 2 and 4
C. 2 and 3
D. 2 and 4
ANSWER: C

29. The square root of the ratio of inertia force to gravity force is called
A. Reynolds number
B. Froude number
C. Mach number
D. Euler number
ANSWER: B

30. Water flows through a 0.6 m diameter, 1000 m long pipe from a 30 m overhead tank to a village. Find the discharge (in liters) at the village (at ground level), assuming a Fanning friction factor f = 0.04 and ignoring minor losses due to bends etc.
A. 0.931 m^3/s
B. 0.834 m^3/s
C. 0.614 m^3/s
D. 0.754 m^3/s
ANSWER: B

31. Water at 25°C is flowing through a 1.0 km long G.I. pipe of 200 mm diameter at the rate of 0.07 m3/s. If value of Darcy friction factor for this pipe is 0.02 and density of water is 1000 kg/m3, the pumping power (in kW) required to maintain the flow is:
A. 1.8
B. 17.4
C. 20.5
D. 41.0
Answer: B

32. Which one of the following statements is true of fully developed flow through pipes?

A. The flow is parallel, has no inertia effects, the pressure gradient is of constant value and the pressure force is balanced by the viscous force.
B. The flow is parallel, the pressure gradient is proportional to the inertia force and there is no viscous effect
C. The flow is parallel, the pressure gradient is negligible and inertia force is balanced by the viscous force.
D. The flow is not parallel, the core region accelerates and the viscous drag is far too less than the inertia force.
Answer: A

33. Assertion (A): For a fully developed viscous flow through a pipe the velocity distribution across any section is parabolic in shape. Reason (R): The shear stress distribution from the centre line of the pipe upto the pipe surface increases linearly.
A. Both A and R are individually true and R is the correct explanation of A
B. Both A and R are individually true but R is not the correct explanation of A
C. A is true but R is false
D. A is false but R is true
Answer: A

34. Aging of pipe implies
A. Pipe becoming smoother with time
B. Relative roughness decreasing with time
C. Increase in absolute roughness periodically with time
D. Increase in absolute roughness linearly with time
Answer: D.

35. The head loss in turbulent flow in pipe varies
A. Directly as the velocity
B. Inversely as the square of the velocity
C. Inversely as the square
D. approximately as the square of the velocity of the diameter
Answer: D

36. The frictional head loss in a turbulent flow through a pipe varies
A. Directly as the average velocity.
B. Directly as the square of the average velocity.
C. Inversely as the square of the average velocity.
D. Inversely as the square of the internal diameter of the pipe.
Answer: B

37. How does the head loss in turbulent flow in pipe vary?
A. Directly as velocity
B. Inversely as square of velocity
C. Approximately as square of velocity
D. Inversely as velocity
Answer: C

38. The value of friction factor is misjudged by + 25% in using Darcy - Weisbach equation. The resulting error in the discharge will be:
A. + 25%
B. – 18.25%
C. – 12.5 %
D. +12.5%
Answer: C.

39. A pipeline connecting two reservoirs has its diameter reduced by 20% due to deposition of chemicals. For a given head difference in the reservoirs with unaltered friction factor, this would cause a reduction in discharge of:
A. 42.8%
B. 20%
C. 17.8%
D. 10.6%
Answer: A

40. The pressure drop in a pipe flow is directly proportional to the mean velocity. It can be deduced that the
A. Flow is laminar
B. Flow is turbulent
C. Pipe is smooth
D. Pipe is rough
Answer: A

41. The hydraulic means depth (where A = area and P = wetted perimeter) is given by]
A. P / A
B. P2 / A
C. A / P
D. $\sqrt{A/P}$
Answer: C.

42. What is hydraulic diameter used in place of diameter for non-circular ducts equal to? Where A = area of flow and m = perimeter
A. A/m
B. 4A/ m
C. A/(4m)
D. 4m/A
Answer: B

43. For a circular channel, the wetted parameter (where R = radius of circular channel, θ= half the angle subtended by the water surface at the centre) is given by:
A. Rθ/ 2
B. 3Rθ

C. 2Rθ

D. Rθ

Answer: C.

44. If coefficient of contraction at the vena contract is equal to 0.62, then what will be the dynamic loss coefficient in sudden contraction in air-conditioning duct?
A. 0.25
B. 0.375
C. 0.55
D. 0.65
Answer: B

45. Assertion (A): There will be a redistribution of pressure and velocity from inside of the bend to the outside while a fluid flows through a pipe bend. Reason (R): The spacing between stream lines will increase towards the outside wall and decrease towards the inside wall of the bend and thereby create a positive pressure gradient between outside wall to inside wall of the bend.
A. Both A and R are individually true and R is the correct explanation of A
B. Both A and R are individually true but R is not the correct explanation of A
C. A is true but R is false
D. A is false but R is true
Answer: A

46. A liquid flows downward through at tapped vertical portion of a pipe. At the entrance and exit of the pipe, the static pressures are equal. If for a vertical height 'h' the velocity becomes four times, then the ratio of 'h' to the velocity head at entrance will be:
A. 3
B. 8
C. 15
D. 24
Answer: C.

47. Which one of the following statements is correct?
A. Hydraulic grade line and energy grade line are the same in fluid problems
B. Energy grade line lies above the hydraulic grade line and is always parallel to it.
C. Energy grade line lies above the hydraulic grade line and they are separated from each other by a vertical distance equal to the velocity head.
D. The hydraulic grade line slopes upwards meeting the energy grade at the exit of flow.
Answer: C.

48. If energy grade and hydraulic grade lines are drawn for flow through an inclined pipeline the following 4 quantities can be directly observed:

1. Static head 2. Friction head
3. Datum head 4. Velocity head

Starting from the arbitrary datum line, the above types of heads will:
A. 3, 2, 1, 4

B. 3, 4, 2, 1
C. 3, 4, 1, 2
D. 3, 1, 4, 2
Answer: D.

49. Which one of the following statements is appropriate for the free surface, the hydraulic gradient line and energy gradient line in an open channel flow?
A. Parallel to each other but they are different lines
B. All coinciding
C. Such that only the first two coincide
D. Such that they are all inclined to each Other
Answer: A

50. Point A of head 'HA' is at a higher elevation than point B of head 'HB'. The head loss between these points is HL. The flow will take place.
A. Always form A to B
B. From A to B if HA + HL = HB
C. From B to A if HA + HL = HB
D. Form B to A if HB + HL = HA
Answer: C.

51. Two pipelines of equal length and with diameters of 15 cm and 10 cm are in parallel and connect two reservoirs. The difference in water levels in the reservoirs is 3 m. If the friction is assumed to be equal, the ratio of the discharges due to the larger diameter pipe to that of the smaller diameter pipe is nearly,
A. 3.375
B. 2.756
C. 2.25
D. 1.5
Answer: B

52. A pipe is connected in series to another pipe whose diameter is twice and length is 32 times that of the first pipe. The ratio of frictional head losses for the first pipe to those for the second pipe is (both the pipes have the same frictional constant):
A. 8
B. 4
C. 2
D. 1
Answer: D.

53. A compound pipeline consists of two pieces of identical pipes. The equivalent length of same diameter and same friction factor, for the compound pipeline is L1 when pipes are connected in series, and is L2 when connected in parallel. What is the ratio of equivalent lengths L1/L2?
A. 32 : 1
B. 8 : 1
C. 2 : 1

D. $\sqrt{2}$:1
Answer: B

54. For maximum transmission of power through a pipe line with total head H, the head lost due to friction hf is given by:
A. 0.1 H
B. H/3
C. H/2
D. 2H/3
Answer: B

55. Assertion (A): The power transmitted through a pipe is maximum when the loss of head due to friction is equal to one-third of total head at the inlet. Reason (R): Velocity is maximum when the friction loss is one-third of the total head at the inlet.
A. Both A and R are individually true and R is the correct explanation of A
B. Both A and R are individually true but R is not the correct explanation of A
C. A is true but R is false
D. A is false but R is true
Answer: C.

56. If H is the total head at inlet and h1 is the head lost due to friction, efficiency of power transmission, through a straight pipe is given by:
A. (H – h1)/H
B. H/(H+h1)
C. (H - h1)/(H+h1)
D. H/(H – h1)
Answer: A

57. A 20 cm diameter 500 m long water pipe with friction factor $u_f = 0.025$, leads from a constant-head reservoir and terminates at the delivery end into a nozzle discharging into air. (Neglect all energy losses other than those due to pipe friction). What is the approximate diameter of the jet for maximum power?
A. 6.67 mm
B. 5.98 mm
C. 66.7 mm
D. 59.8 mm
Answer: D.

58. Water hammer in pipe lines takes place when
A. Fluid is flowing with high velocity
B. Fluid is flowing with high pressure
C. Flowing fluid is suddenly brought to rest by closing a valve.
D. Flowing fluid is brought to rest by gradually closing a valve.
Answer: C.

59. Which phenomenon will occur when the value at the discharge end of a pipe connected to a reservoir is suddenly closed?
A. Cavitation
B. Erosion
C. Hammering
D. Surging
Answer: C.

60. Which one of the following statements relates to expression ' ρvc'?
A. Pressure rise in a duct due to normal closure of valve in the duct
B. Pressure rise in a duct due to abrupt closure of valve in the duct
C. Pressure rise in a duct due to slow opening of valve in the duct
D. Pressure rise in a duct due to propagation of supersonic wave through the duct
Answer: D.

61. Assertion (A): Head loss for sudden expansion is more than the head loss for a sudden contraction for the same diameter ratio. Reason (R): Head loss varies as the square of the upstream and downstream velocities in the pipe fitted with sudden expansion or sudden contraction.
A. Both A and R are individually true and R is the correct explanation of A
B. Both A and R are individually true but R is not the correct explanation of A
C. A is true but R is false
D. A is false but R is true
Answer: C.

62. Two pipelines of equal lengths are connected in series. The diameter of the second pipe is two times that of the first pipe. The ratio of frictional head losses between the first pipe and the second pipe is:
A. 1:32
B. 1:16
C. 1:8
D. 1:4
Answer: A

63. A pipeline is said to be equivalent to another, if in both
A. Length and discharge are the same
B. Velocity and discharge are the same
C. Discharge and frictional head loss are the same
D. Length and diameter are the same
Answer: C.

64. In a pipe flow, the head lost due to friction is 6 m. If the power transmitted through the pipe has to be the maximum then the total head at the inlet of the pipe will have to be maintained at
A. 36 m
B. 30 m
C. 24 m

D. 18 m
Answer: D.

65. For a 1: m scale model of a hydraulic turbine, the specific speed of the model Nsm is related to the prototype specific speed Nsp as
A. Nsm = Nsp/m
B. Nsm = mNsp
C. Nsm = (Nsp)1/m
D. Nsm = Nsp
Answer: D.

1. If there are n variables in a dimensionally homogeneous equation and if these variables contain m primary dimensions, then the variables can be grouped into how many non-dimensional parameters?
A. m
B. n-m
C. n-2m
D. n
ANSWER: B

2. What is the dimension of resistance?
A. $M L T^{2}$
B. M L T
C. $M L T^{-2}$
D. $M L T^{-1}$
ANSWER: C

3. If there are 6 physical quantities and 3 fundamental units, then the number of pi terms is
A. 1
B. 2
C. 3
D. 4
ANSWER: C

4. The study of predicting prototype conditions from model observations is known as
A. Similitude
B. Geometrical similarity
C. Prototype
D. Model
ANSWER: A

5.S.I unit of heat is
A. J
B. W
C. J s
D. W/K
ANSWER: A

6. S.I unit of coefficient of volumetric expansion is
A. Degree

B. Per meter
C. Per second
D. Per degree
ANSWER: D

7. S.I unit of specific heat is
A. K kg/J
B. kg/K
C. k J/kg K
D. J/K
ANSWER: C

8. S.I unit of dynamic viscosity is
A. kg/m
B. kg/m s
C. m/kg
D. m s /kg
ANSWER: B

9. Which of the following is an advantage of dimensional analysis?
A. It expresses the functional relationship between the variables in dimensionless terms
B. In hydraulic model studies it reduces the number of variables involved in a physical phenomenon, generally by three.
C. By the use of dimensional analysis design curves can be developed from experimental data or direct solution of the problem
D. all of the above
ANSWER: D

10 In dimensional analysis the Buckingham's Pi theorem is widely used and expresses the resulting equation in terms of
A. The repeating variables
B. Geometric, Kinematic and dynamic variables
C. (n-m)dimensionless parameters
D. n dimensionless parameters
ANSWER: C

Model Studies and Similitude

11. Which is a full size structure employed in the actual engineering design?
A. Proton
B. Prototype
C. Electron
D. Neutron
ANSWER: B

12. Which term refers to the theory and art of predicting prototype conditions from model observations?
A. Nusselt number
B. Dimensional homogeneity
C. Thermal boundary layer
D. **Similitude**
ANSWER: D

13. Thermal similarity refers to the comparison of two systems made on the basis of their
A. Temperature

B. Specific heat
C. Heat flux
D. Length
ANSWER: D

14. The comparison of two systems made on the basic of their temperature, specific heat and heat flus is known as
A. Dynamic similarity
B. Kinematic similarity
C. Thermal similarity
D. Geometrical similarity
ANSWER: C

15 The similarity of masses and forces of the corresponding particles of flow is known as
A. Kinematic similarity
B. Dynamic similarity
C. Geometrical similarity
D. Thermal similarity
ANSWER: B

16. The similarity of motion is known as
A. Thermal similarity
B. Dynamic similarity
C. Geometrical similarity
D. Kinematic similarity
ANSWER: D

17. The similarity of shape and form is known as
A. Geometrical similarity
B. Thermal similarity
C. Geometrical similarity
D. Kinematic similarity
ANSWER: A

18. --- is equal to the product of shear stress due to viscosity and surface area of flow
A. Viscous force
B. Inertia force
C. Pressure force
D. Gravity force
ANSWER: A

19. Dynamic similarity between the model and prototype is the
A. Similarity of motion
B. Similarity of lengths
C. Similarity of forces
D. None of the above
ANSWER: C

20. In order that results obtained in model studies correctly represent the behavior of the prototype, which of the following similarities must be ensured between the model and the prototype?
A. Dynamic similarity
B. Geometrical similarity
C. Kinematic similarity
D. All of the above

ANSWER: D

Dimensional Analysis- Advantages and Limitations

21. Ratio of actual velocity to sonic velocity is known as
A. Mach number
B. Peclet number
C. Reynolds number
D. Grashof number
ANSWER: A

22 The value of Prandtl number for air is about
A. 0.1
B. 0.4
C. 0.7
D. 1.1
ANSWER: C

23 Let us say Mach number (greater than one), the flow is
A. Sonic
B. Subsonic
C. Supersonic
D. No flow
ANSWER: C

24. Free convection heat flow does not depends on
A. Density
B. Coefficient of viscosity
C. Gravitational force
D. Velocity
ANSWER: B

25 Which dimensionless number has a significant role in forced convection?
A. Prandtl number
B. Peclet number
C. Mach number
D. Reynolds number
ANSWER: D

26. The non-dimensional parameter known as Stanton number is used in
A. Forced convection heat transfer
B. Condensation heat transfer
C. Natural convection heat transfer
D. Unsteady state heat transfer
ANSWER: A

27. The Prandtl number will be lowest for
A. Water
B. Liquid metal
C. Lube oil
D. Aqueous solution
ANSWER: B

28. The dimensionless parameter $L^3 p^2 \beta g d t/\mu^2$ is referred to as
A. Stanton number
B. Schmidt number
C. Grashof number

D. Peclet number
ANSWER: C

29. The scale effect in models can be
A. Positive only
B. Negative only
C. Both positive and negative
D. None of the above
ANSWER: C

30. Distorted models are required to be prepared for which of the following?
A. Rivers
B. Dams across very wide rivers
C. Harbours
D. All of the above
ANSWER: D

Significance of Dimensionless Groups

31. Ratio of inertia force to viscous force is known as
A. Grashof number
B. Reynolds number
C. Peclet number
D. Stanton number
ANSWER: B

32. The ratio of heat flow rate by convection to flow rate by conduction is known as
A. Stanton number
B. Graetz number
C. Fourier number
D. Peclet number
ANSWER: D

33. The ratio of heat capacity of fluid flowing through the pipe per unit of length to the conductivity of pipe material is known as
A. Graetz number
B. Reynolds number
C. Peclet number
D. Fourier number
ANSWER: A

34. What is the value of Prandtl number for highly viscous oils?
A. 100-1000
B. 0-100
C. 10-100
D. 100-10000
ANSWER: D

35. What is the value of Prandtl number for liquid metals?
A. 0.003-0.01
B. 0.01-0.1
C. 0.1-0.5
D. 0.5-0.95
ANSWER: A

36. The product of buoyant force and inertia force to the square of the viscous force is known as

A. Stanton number
B. Grashof number
C. Fourier number
D. Peclet number
ANSWER: B

37. The ratio of heat transfer coefficient to the flow of heat per unit temperature rise due to the velocity of the fluid is known as
A. Fourier number
B. Grashof number
C. Peclet number
D. Stanton number
ANSWER: D

38. Which number establishes the relation between convective film coefficient, thermal conductivity of the fluid and a significant length parameter?
A. Nusselt number
B. Stanton number
C. Peclet number
D. Fourier number
ANSWER: A

39. ----is the ratio of the inertia force to the viscous force
A. Reynolds's number
B. Stanton number
C. Peclet number
D. Fourier number
ANSWER: A

40. ----is the square root of the ratio of the inertia force to the pressure force.
A. Euler's number
B. Stanton number
C. Peclet number
D. Fourier number
ANSWER: A

Laminar and turbulent

41. If layers of fluid have frictional force between them, then it is known as
A. viscous
B. non-viscous
C. incompressible
D. both a and b
ANSWER: A

42.If every particle of fluid has irregular flow, then flow is said to be
A. laminar flow
B. turbulent flow
C. fluid flow
D. both a and b
ANSWER: B

43. If every particle of fluid follows same path, then flow is said to be
A. laminar flow
B. turbulent flow

C. fluid flow
D. both a and b
ANSWER: A

44. A racing car has a body with
A. laminated design
B. turbulent design
C. flat design
D. streamlined design
ANSWER: D

45. Force due to water flow is represented by formula
A. F = (-m/t)V
B. F = (-t)V
C. F = (-m)V
D. F = (-m/t)
ANSWER: A

46. Streamline and equipotential lines in a flow field
A. are parallel to each other
B. are identical to each other
C. are perpendicular to each other
D. intersect at acute angles
ANSWER: C

47. If the Reynolds number is less than 2000, the flow in a pipe is
A. Turbulent
B. Laminar
C. Transition
D. None of the above
ANSWER: B

48. A flow is called super-sonic if the
A. velocity of flow is very high
B. discharge is difficult to measure
C. Mach number is between 1 and 5
D. Mach number is less than 1
ANSWER: C

49. Assume a turbulent flow of a fluid on a flat plate. A very thin region near the plate surface is called as
A. Laminar buffer layer
B. Laminar sub layer
C. Laminar turbulent layer
D. none of the above
ANSWER: B

50. The layer above the laminar sub layer with some turbulence and still having importance of viscous action is called as
A. sub-sub layer
B. turbulent layer
C. buffer layer
D. none of the above
ANSWER: C

51. An oil of specific gravity 0.92 and viscosity 0.03 poise is to be transported at the rate of 2500 liters/sec.through a1.2 m diameter pipe. Tests were conducted on a 12 cm diameter pipe using water at 20°C.If the viscosity water at 20°C is 0.01 poise, what is a velocity of flow in the model?

A. V_p = 2.21 m/s V_m= 6.78 m/s
B. V_p = 4.21 m/s V_m= 3.78 m/s
C. V_p = 2.41 m/s V_m= 6.78 m/s
D. V_p = 6.21 m/s V_m= 2.78 m/s
ANSWER: A

Explanation:

$$\frac{\rho_m V_m D_m}{\mu_m} = \frac{\rho_p V_p D_p}{\mu_p}$$

$$\frac{V_m}{V_p} = \frac{\rho_p}{\rho_m}\frac{D_p}{D_m}\frac{\mu_m}{\mu_p} = \frac{0.92}{1} * \frac{1.2}{0.12} * \frac{0.001}{0.003} = 3.067$$

$$V_p = \frac{Q_p}{A_p} = 2.21\frac{m}{s} V_m = 5.78 m/s$$

52. An orifice meter to carry water is calibrated with air in a geometrically similar model at 1/5 prototype scale. Dynamically similar flow will be obtained when the discharge ratio (air to water)is-------. Assume the ratio of kinematic viscosity of air to water as 12.5

A. $\frac{Q_m}{Q_p} = 2.5$
B. $\frac{Q_m}{Q_p} = 4.5$
C. $\frac{Q_m}{Q_p} = 6.5$
D. $\frac{Q_m}{Q_p} = 1.5$
ANSWER: A

Explanation

$$\frac{L_m}{L_p} = \frac{1}{5}$$

$$\frac{v_{air}}{v_{water}} = \frac{v_m}{v_p} = 12.5$$

Reynolds numbers in model and prototype are equal,

$$\frac{V_m L_m}{v_m} = \frac{V_p L_p}{v_p}$$

$$\frac{V_m}{V_p} = \frac{v_m}{v_p} \times \frac{L_p}{L_m} = 12.5 \times 5 = 62.5 \qquad \frac{Q_m}{Q_p} = \frac{L_m^2}{L_p^2} \times \frac{V_m}{V_p} = \left(\frac{1}{5}\right)^2 \times 62.5 = 2.5$$

53 In the model test of a spillway the discharge and velocity of flow over the model were 2.5m^3/s and 1.5 m/s respectively. What is the velocity over the prototype which is 36 times the model size?

A. $V_p = 9\ m/s$
B. $V_p = 8\ m/s$
C. $V_p = 12\ m/s$
D. $V_p = 15\ m/s$
ANSWER: A

Explanation: $\frac{V_p}{V_m} = \sqrt{L_r} = \sqrt{36} = 6$ $V_p = 1.5 \times 6 = 9 m/s$

54. In a geometrically similar model of spillway the discharge per metre length is $0.2m^3/s$.If the scale of the model is $\frac{1}{36}$,what the discharge per meter run of the prototype is-------

A. $q_p = 43.2\ m^3/s$

B. $q_p = 83.2\ m^3/s$

C. $q_p = 13.2\ m^3/s$

D. $q_p = 23.2\ m^3/s$

ANSWER: A

$$\frac{q_p}{q_m} = \frac{q_p/L_p}{q_m/L_m} = \frac{q_p}{q_m} \times \frac{i_m}{i_p} = L_r^{3/2} \times \frac{1}{L_r} = L_r^{1/2}$$

$$\frac{q_p}{q_m} = (36)^{1/2} = 216 = 0.2 \times 216 = \frac{48.2m^3}{s}$$

Loss of Energy in Pipes

55. Which one of the following is a major loss?

A. Frictional loss

B. Shock loss

C. Entry loss

D. Exit loss

ANSWER: A

56. Which property of the fluid accounts for the major losses in pipes?

A. Density

B. Specific gravity

C. Viscosity

D. Compressibility

ANSWER: C

57. The frictional resistance for fluids in motion is

A. Proportional to the velocity in laminar flow and to the square of the velocity in turbulent flow

B. Proportional to the square of the velocity in laminar flow and to the velocity in turbulent flow

C. Proportional to the velocity in both laminar flow and turbulent flow

D. Proportional to the square of the velocity in both laminar flow and turbulent flow

ANSWER: A

58. The frictional resistance for fluids in motion is

A. Inversely proportional to the square of the surface area of contact

B. Inversely proportional to the surface area of contact

C. Proportional to the square of the surface area of contact

D. Proportional to the surface area of contact

ANSWER: D

59. A liquid flows through pipes 1 and 2 with the same flow velocity. If the ratio of their pipe diameters d_1: d_2 be 3:2, what will be the ratio of the head loss in the two pipes?

A. 3:2

B. 9:4

C. 2:3

D. 4:9

ANSWER: C

Explanation

$$h_f = \frac{4fL}{D} \times \frac{v^2}{2g}$$

Where h_f is the head loss in the pipe, f is the co-efficient of friction, L is the length, D is the diameter and V is the flow velocity. Thus, $h_{f1} : h_{f2} = D_2 : D_1 = 2 : 3$.

60. A liquid flows through two similar pipes 1 and 2. If the ratio of their flow velocities $v_1 : v_2$ be 2:3, what will be the ratio of the head loss in the two pipes?
A. 3:2
B. 9:4
C. 2:3
D. 4:9
ANSWER: D

Explanation

$$h_f = \frac{4fL}{D} \times \frac{v^2}{2g}$$

Where h_f is the head loss in the pipe, f is the co-efficient of friction, L is the length, D is the diameter and V is the flow velocity. Thus, h_{f1}: hf2 = v1 : v2 = 4 : 9.

61. The head loss at the entrance of the pipe is that at its exit
A. Equal to
B. Half
C. Twice
D. four times
ANSWER: B

Explanation
$h_i = o.5v^2 / 2g$ and ho = v2 / 2g, where h_i is the head loss at pipe entrance, h_o is the head loss at pipe exit and v is the flow velocity. Thus hi = $0.5h_o$

Hydraulic Gradient and Total Energy Line

62. Energy gradient line takes into consideration
A. Potential and kinetic heads only
B. Potential and pressure heads only
C. Kinetic and pressure heads only
D. Potential, kinetic and pressure heads
ANSWER: D

Explanation:

$$\frac{P}{\rho g} + Z + \frac{V^2}{2g} = H$$

63. The laminar/viscous flow is characterized by Reynolds number which is
A. Less than the critical value
B. Equal to critical value
C. More than critical value
D. None of the above
ANSWER: A

64. The laminar flow is characterized by
A. Existence of eddies
B. Irregular motion of fluid particles
C. Fluid particles moving in layers parallel to boundary surface

D. None of the above
ANSWER: C

65 Which of the following is an example of laminar flow?
A. Underground flow
B. Flow past tiny bodies
C. Flow of oil in measuring instruments
D. All of the above
ANSWER: D

66. In case of laminar flow, the loss of pressure head in proportional to
A. Velocity
B. Velocity ^{2}
C. Velocity ^{3}
D. Velocity ^{4}
ANSWER: A

67 ---studies the laminar flow through a circular tube experimentally
A. Prandtl
B. Pascal
C. Hagen and poiseuille
D. None of the above
ANSWER: C

68--is most commonly used equation for the velocity distribution for laminar flow through pipes.
A. $u = u_{max}\left[1 - \frac{r}{R}\right]$
B. $u = u_{max}\left[1 - \left(\frac{r}{R}\right)^{2}\right]$
C. $u = u_{max}\left[1 - \left(\frac{r}{R}\right)^{3}\right]$
D. $u = u_{max}\left[1 - \left(\frac{r}{R}\right)^{4}\right]$
ANSWER: B

69.In laminar flow the pressure drop per unit length of pipe $(\Delta P/L)$ is given as
A. $\frac{32\mu\bar{u}}{D^2}$
B. $\frac{8\mu\bar{u}}{D^2}$
C. $\frac{32\mu\bar{u}}{D^4}$
D. $\frac{8\mu\bar{u}}{D^4}$
ANSWER: A

70. The K.E correction factor α for a circular pipe is equal to
A. 2
B. 3
C. 4
D. 5
ANSWER: A

71. The momentum correction factor β for a circular pipe is to equal to
A. 1/3
B. 2/3

C. 4/3
D. 7/3
ANSWER: C

72. For viscous flow the co-efficient of friction is given by
A. $f = \frac{\tau}{\rho v^2}$
B. $f = \frac{16}{\rho v^2}$
C. $f = \frac{32}{\rho v^2}$
D. $f = \frac{60}{\rho v^2}$
ANSWER: B

73. In case of viscous flow through circular pipes
A. $\bar{u} = 2u_{max}$
B. $\bar{u} = \frac{u_{max}}{2}$
C. $\bar{u} = \frac{3u_{max}}{2}$
D. $\bar{u} = \frac{5u_{max}}{2}$
ANSWER: B

74. The maximum velocity in a circular pipe when flow is laminar occurs at
A. The top of the pipe
B. The bottom of the pipe
C. The center of the pipe
D. Not necessarily at the center.
ANSWER: C

75. The shear in turbulent flow is mainly due to
A. Heat transfer
B. Mass transfer
C. Momentum transfer
D. Shear transfer
ANSWER: C

76. Turbulent is flow is characterized by which of the following?
A. Fluctuating components of velocities
B. Cross currents and eddies with intermixing of particles
C. Excess energy dissipation with rise in temperature
D. All the above
ANSWER: D

77. The flow in town water supply pipes is generally
A. Laminar
B. Turbulent
C. Transition
D. Any of the above
ANSWER: B

78. in turbulent flow the velocity distribution is a function of the distance y measured from the boundary surface and shear friction velocity u_f and follow a
A. Linear law
B. Hyperbolic law
C. Parabolic law
D. Logarithmic law

ANSWER: D

79. The Darcy weibach friction factor f which is direct measure of resistance to flow in pipes depends on which of the following?
A. Relative roughness, Velocity and viscosity
B. Relative roughness, diameter and viscosity
C. Roughness height, Velocity and diameter
D. Roughness height, diameter and velocity and kinematic viscosity
ANSWER: D

Flow through pipes

80.In case of a laminar flow, the loss of pressure head is
A. Proportional to velocity ^{2}
B. Proportional to velocity
C. Proportional to velocity $^{2/3}$
D. Proportional to velocity $^{4/3}$
ANSWER: B

81 Darcy weibach equations is used to find loss of head due to
A. Sudden enlargement
B. Sudden contraction
C. Sudden enlargement and contraction
D. Friction
ANSWER: D

82 Chezy's formula is given as
A. $V=C\sqrt{mi}$
B. $V=C\sqrt{m^2i}$
C. $V=C\sqrt{mi^2}$
D. $V=\sqrt{mi}$
ANSWER: A

83. Loss of head due to sudden enlargement is given as
A. $h_e = \frac{(v_1-v_2)^2}{2g}$
B. $h_e = \frac{(v_1-v_2)^2}{2g}$
C. $h_e = \frac{(v_1-v_2)^2}{2g}$
D. $h_e = \frac{(v_1-v_2)^2}{2g}$
ANSWER: B

84 Loss of head due to sudden contraction is given as
A. $h_c = \frac{v_2^2}{2g}\left[\frac{1}{c_c}-1\right]^2$
B. $h_c = \frac{v_2^2}{g}\left[\frac{1}{c_c}-1\right]^2$
C. $h_c = \frac{v_2^2}{2g}\left[\frac{1}{c_c}-1\right]^2$
D. $h_c = \frac{v_2^2}{2g}\left[\frac{1}{c_c}-1\right]^2$
ANSWER: C

85 Loss of head due to an obstruction is given as

A. $h_{obs} = \left[\frac{A}{C_c(A-a)} - 1\right]^1 \frac{V^2}{2g}$

B. $h_{obs} = \left[\frac{A}{C_c(A-a)} - 1\right]^2 \frac{V^2}{2g}$

C. $h_{obs} = \left[\frac{A}{C_c(A-a)} - 1\right]^3 \frac{V^2}{2g}$

D. $h_{obs} = \left[\frac{A}{C_c(A-a)} - 1\right]^4 \frac{V^2}{2g}$

ANSWER: C

86 Losses of head at entrance to a pipe is given as

A. $h_i = \frac{V^2}{2g}$

B. $h_i = 0.5 \frac{V^2}{2g}$

C. $h_i = 3 \frac{V^2}{2g}$

D. $h_i = 5 \frac{V^2}{2g}$

ANSWER: B

87 Loss of head at exit of a pipe is given as

A. $h_o = \frac{V^1}{2g}$

B. $h_o = \frac{V^2}{2g}$

C. $h_o = \frac{V^3}{2g}$

D. $h_o = \frac{V^4}{2g}$

ANSWER: B

88 Loss of head at bend in the pipe is given as

A. $h_b = K \frac{V^2}{2g}$

B. $h_b = K \frac{V^3}{2g}$

C. $h_b = K \frac{V^4}{2g}$

D. $h_b = K \frac{V^5}{2g}$

ANSWER: A

89 Loss of head in various pipe fittings is given as

A. $h_{fittings} = K \frac{V^2}{2g}$

B. $h_{fittings} = K \frac{V^3}{2g}$

C. $h_{fittings} = K \frac{V^4}{2g}$

D. $h_{fittings} = K \frac{V^5}{2g}$

ANSWER: A

90.The energy loss in a pipe line is due to
A. Surface roughness only
B. Viscous action only
C. Friction offered by pipe wall as well as by viscous function
D. None of the above

ANSWER: C

91. The entrance length or length of establishment of flow is
A. The length in which the boundary layer remains uniform
B. The pipe length inside the reservoir
C. The length of pipe from its entrance in which the flow may be assumed ir-rotational
D. The initial length in which the flow develops fully such that the velocity profile does not change downstream
ANSWER: D

92.In a pipe of diameter 350mm and length 75m water is flowing at a velocity of 2.8m/s.Find the head lost due to friction-----
A. H_f =0.9m
B. H_f =0.8m
C. H_f =0.7m
D. H_f =0.6m
ANSWER: A

93.L_1, L_2, L_3 and the length of three pipes, connected in series .If d_1, d_2, d_3 are their diamters, then the equivalent size of the pipe is given by,
A. $\frac{L}{D^5} = \left\{\frac{L_1}{D_1^5} + \frac{L_2}{D_2^5} + \frac{L_3}{D_3^5}\right\}$
B. $\frac{L}{D^4} = \left\{\frac{L_1}{D_1^4} + \frac{L_2}{D_2^4} + \frac{L_3}{D_3^4}\right\}$
C. $\frac{L}{D^3} = \left\{\frac{L_1}{D_1^3} + \frac{L_2}{D_2^3} + \frac{L_3}{D_3^3}\right\}$
D. $\frac{L}{D^2} = \left\{\frac{L_1}{D_1^2} + \frac{L_2}{D_2^2} + \frac{L_3}{D_3^2}\right\}$
ANSWER: A

94. The power transmitted through pipe is given by
A. $\frac{\rho g \times Q \times H}{1000}$
B. $\frac{\rho g \times Q \times h_f}{1000}$
C. $\frac{\rho g \times Q \times (H - h_f)}{4500}$
D. $\frac{\rho g \times Q \times (H - h_f)}{1000}$
ANSWER: D

95. Efficiency of power transmission through pipe is given by
A. $\frac{H - h_f}{H}$
B. $\frac{H}{H + h_f}$
C. $\frac{H - h_f}{H + h_f}$
D. $\frac{H + h_f}{H + h_f}$
ANSWER: A

96. Maximum efficiency of power transmission through pipe is
A. 50 %
B. 66.67%
C. 75%
D. 100%
ANSWER: B

97. The maximum velocity through a circular channel takes place when depth of flow is equal to
A. 0.95 times the diameter
B. 0.5 times the diameter
C. 0.81 times the diameter
D. 0.05 times the diameter
ANSWER: C

98. For a circular channel, the wetted perimeter is given by
A. Rθ/2
B. 3Rθ
C. 2Rθ
D. Rθ
ANSWER: C

99. Maximum efficiency of a series of vertical plates is
A. 50 %
B. 66.67%
C. 75%
D. 100%
ANSWER: A

100. When the pipes are connected in parallel the total loss of head
A. Is equal to the sum of the loss of head in each pipe
B. Is same as in each pipe
C. Is equal to the reciprocal of the sum of loss of head in each pipe
D. None of the above
ANSWER: B

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1. hydraulic turbine converts the potential energy of water into
    a) Kinetic energy
    b) Heat energy
    c) Thermal energy
    d) Gravitational energy

(Ans:a)

2. Impulse turbine requires
    a) High head and low discharge
    b) High head and high discharge
    c) Low head and low discharge
    d) Low head and high discharge

(Ans:a)

3. Reaction turbine requires
    a) High head and low discharge

b) High head and high discharge
c) Low head and low discharge
d) Low head and high discharge

(Ans:d)

4. Which of the following is an impulse turbine?
    a) Pelton turbine
    b) Francis turbine
    c) Kaplan turbine
    d) Propeller turbine

(Ans:a)

5. Pelton turbine is _____
    a) Tangential flow
    b) Radial flow
    c) Axial flow
    d) Mixed flow

(Ans:a)

6. Kaplan turbine is _____
    a) Tangential flow
    b) Radial flow
    c) Axial flow
    d) Mixed flow

(Ans:b)

7. Francis turbine is _____
    a) Tangential flow
    b) Radial flow
    c) Axial flow
    d) Mixed flow

(Ans:d)

8. If the blades of the axial flow turbine are fixed, these are called
    a) Kaplan turbine
    b) Propeller turbine
    c) Francis turbine
    d) Pelton turbine

(Ans:b)

9. In mixed flow turbines, the water enters the blades ____ and comes out _____
    a) radially, axially
    b) radially, radially
    c) axially, radially
    d) axially, axially

(Ans:a)

10. The specific speed of a turbine is, Where N = Normal working speed (r.p.m.), P = Power output, H=Net head (in metres)
    a) N√P / H^1/4
    b) N√P / H^3/4
    c) N√P / H^5/4
    d) N√P / H^7/4

(Ans:c)

11. In reaction turbines, the runner utilizes
    a) Kinetic energy
    b) Potential energy
    c) Both kinetic energy and potential energy
    d) None of the above

(Ans:c)

12. The function of draft tube is to
    a) increase the pressure of the exiting fluid
    b) increase the Kinetic energy of exiting fluid
    c) allow the turbine to be set below tail water level
    d) keep pressure at runner outlet above the atmospheric pressure

(Ans:a)

13. Cavitation occurs at
    a) high pressure
    b) low pressure
    c) atmospheric pressure
    d) none of the above

(Ans:a)

14. In cavitation, the material fails
    a) by fatigue
    b) due to creep
    c) due to impact load
    d) due to fracture

(Ans:a)

15. An impulse turbine is used for
    a. Low head of water
    b. High head of water
    c. Medium head of water
    d. High discharge

(Ans:b)

16. Francis turbine is
    a. A reaction radial flow turbine
    b. An axial flow turbine
    c. A radial flow turbine
    d. An impulse turbine

(Ans:a)

17. A draft tube is not required for a
    a. Francis turbine
    b. Kaplan turbine
    c. Pelton wheel turbine
    d. None of the above

(Ans:c)

18. Gross head is the difference between _____.

    a. head race and tail race
    b. head race and net head
    c. head race and friction losses
    d. net head and friction losses

(Ans:a)

19. The energy of water entering the reaction turbine is _____

    a. fully the kinetic energy
    b. fully the pressure energy
    c. partly the pressure energy and partly the kinetic energy
    d. unpredictable

(Ans:c)

20. which of the following is an example of impulse turbine?

    a. Propeller turbine

b. Francis turbine
c. Kaplan turbine
d. Pelton wheel

Ans:d)

21. What is the head of water available at turbine inlet in hydro-electric power plant called?

a. head race
b. tail race
c. gross head
d. net head

(Ans:d)

22. What is runaway speed of the runner of Pelton wheel?

a. maximum unsafe speed of the runner due to sudden increase in load on turbine
b. minimum safe speed of the runner due to sudden increase in load on turbine
c. maximum unsafe speed of the runner due to sudden decrease in load on turbine
d. minimum safe speed of the runner due to sudden decrease in load on turbine
e. (Ans:c)

23. The mechanical efficiency of an impulse turbine is

a) ratio of the actual power produced by the turbine to the energy actually supplied by the turbine
b) ratio of the actual work available at the turbine to the energy imparted to the wheel
c) ratio of the Work done on the wheel to the energy of the jet
d) none of the above

Ans: b

24. In a Kaplan turbine runner, the number of blades are generally between

a) 2 to 4
b) 4 to 8
c) 8 to l6
d) 16 to 24

Ans: b

25. The speed of a turbine runner is

a) directly proportional to H1/2
b) inversely proportional to H1/2

c) directly proportional to H3/2
d) inversely proportional to H3/2

Ans: a

26. In a reaction turbine, the draft tube is used
    a) to run the turbine full
    b) to prevent air to enter the turbine
    c) to increase the head of water by an amount equal to the height of the runner outlet above the tail race
    d) to transport water to downstream

Answer: Option C

27. The efficiency of a Pelton wheel working under constant head _____ with the increase in power.
    a) remains same
    b) increases
    c) decreases
    b. zero

Answer: Option B

28. Which of the following turbine is preferred for 0 to 25 m head of water?
    a) Pelton wheel
    b) Kaplan turbine
    c) Francis turbine
    d) none of these

Answer: Option B

29. The overall efficiency of a reaction turbine is the ratio of
    a) power produced by the turbine to the energy actually supplied by the turbine
    b) actual work available at the turbine to the energy imparted to the wheel
    c) workdone on the wheel to the energy (or head of water) actually supplied to the turbine
    d) none of the above

Answer: Option A

30. The maximum number of jets, generally, employed in an impulse turbine without jet interference are
    a) two
    b) four

c) six
d) eight

Answer: Option C

31. A centrifugal pump will start delivering liquid only when the pressure rise in the impeller is equal to the
    a) kinetic head
    b) velocity head
    c) manometric head
    d) static head

Answer: Option C

32. The runaway speed of a hydraulic turbine is the speed
    a) at full load
    b) at which there will be no damage to the runner
    c) corresponding to maximum overload permissible
    d) at which the turbine will run freely without load

Answer: Option D

33. The cavitation in a hydraulic machine
    a) causes noise and vibration of various parts
    b) reduces the discharge of a turbine
    c) causes sudden drop in power output and efficiency
    d) all of the above

Answer: Option D

34. A turbine develops 10000 kW under a head of 25 metres at 135 r.p.m. Its specific speed is
    a) 175.4 r.p.m.
    b) 215.5 r.p.m.
    c) 241.5 r.p.m.
    d) 275.4 r.p.m

Answer: Option C

35. A centrifugal pump running at 500 rpm and its maximum efficiency is delivering a head of 30 m at flow rate of 60 litre per minutes. If the rpm is changed to 1000, then the head H in metres and flow rate Qin litresper minute at maximum efficiency are estimated to be

(A) H=60, Q=120

(B) H=120, Q=120

(C) H= 60, Q=4800

(D) H= 120, Q=30

Ans B

36. At hydroelectric power site, available head and flow rate are 24.5 m and 10.1 respectively. If the turbine to be installed is required to run at 4.0 revolution per second (rps) with an overall efficiency 90%, then suitable type of turbine for the site is

(A) Francis

(B) Kaplan

(C) Pelton

(D) Propeller

(Ans A)

37. A centrifugal pump is required to pump water to an open water tank situated 4 km away from the location of the pump through a pipe diameter 0.2 m having Darcy friction factor of 0.01. The average speed of water in the pipe is 2 m/s. If it is to maintain a constant head of 5m in the tank, neglecting other minor losses, then absolute discharge pressure at the pump exit is

(A) 0.449 bar

(B) 5.503 bar

(C) 44.911 bar

(D) 55.203 bar

(Ans B)

38. A horizontal shaft centrifugal pump lifts water at 65 degree celcius. The suction nozzle is one meter below pump centerline. The pressure at this point is equal to 200 kPa gauge and velocityis 3 meter per sec. Steam tables show saturation pressure at 65 degree celciusis 25 kPa, and specific volume of the saturated liquid is 0.0010 meter cube per kg. The pump Net Positive Suction Head (NPSH) in meters is

(A) 24

(B) 26

(C) 28

(D) 30

(Ans A)

39. A large hydraulic turbine is to generate 300 kW at 1000 rpm under a head of 40 m. For initial testing , a 1:4 scale model of the turbine operates under a head of 10 m. The power generated by the model (in KW) will be

(A) 2.34

(B) 4.68

(C) 9.38

(D) 18.75

(Ans A)

40. In a peltonwherel, the bucket peripheral speed is 10 m/s, the water jet velocity is 25 m/s and volumetric flow rate of the jet is 0.1 meter cube per sec. If the jet deflection angle is 120 degree celcius and the flow is ideal, the output developed is

(A) 7.5 kW

(B) 15.0 kW

(C) 22.5 kW

(D) 37.5 Kw

(Ans C)

41. The inlet angle of runner blades of a Francis turbine is 90 degree celcius. The blades are so shaped that the tangential component of velocity at blade outlet is zero. The flow velocity remains constant throughout the blade passage and is equal to half of the blade velocity at runner inlet. The blade efficiency of the runner is

(A) 25 %

(B) 50 %

(C) 80 %

(D) 89 %

(Ans C)

42. A hydraulic turbine develops 1000 kW power for a head of 40m. if the head id reduced to 20 m, the power developed (in kW) is

(A) 177

(B) 354

(C) 500

(D) 707

(Ans B)

43. In order to have maximum power from a pelton turbine, the bucket speed must be

(A) Equal to jet speed

(B) Equal to half of the jet speed

(C) Equal to twice of the jet speed

(D) Independent of the jet speed

(Ans B)

44. In a Pelton wheel, the bucket peripheral speed is 10 m/s, the water jet velocity is 25 m/s and volumetric flow rate of the jet is 0.1 meter cube per sec. If the jet deflection angle is120 degree Celsius and the flow is ideal, the power developed is:

(a) 7.5kW

(b) 15.0 kW

(c) 22.5kW

(d) 37.5kW

Ans. (c)

45. Water, having a density of 1000 kg/m3, issues from a nozzle with a velocity of 10 m/s and the jet strikes a bucket mounted on a Pelton wheel. The wheel rotates at 10 rad/s. The mean diameter of the wheel is I m. The jet is split into two equal streams by the bucket, such that each stream is deflected by 120°, as shown in the figure. Friction i n t h e b u c k e t m a y b e neglected. Magnitude of the torque exerted by the water on the wheel, per unit mass flow rate of the incoming jet, is:

(a) 0 (N.m) / (kg/s)

(b) 1.25 (N.m) / (kg/s)

(c) 2.5(N.m) / (kg/s)

(d) 3.75(N.m) / (kg/s)

Ans. (d)

46. Kaplan turbine is:

(a) A high head mixed flow turbine

(b) A low head axial flow turbine

(c) An outward flow reaction turbine

(d) An impulse inward flow turbine

Ans. (b)

47. The specific speed of an impulse hydraulic turbine will be greater than the specific speed of a reaction type hydraulic turbine.

(a) True

(b) False

(c) Increase

(d) Decrease

Ans. (b)

48. At a hydro electric power plant site, available head and flow rate are 24.5 m and 10.1 m3/s respectively. If the turbine to be installed is required to run at 4.0 revolution per second (rps) with an overall efficiency of 90%, then suitable type of turbine for this site is:

(a)Francis

(b) Kaplan

(c) Pelton

(d) Propeller

Ans. (a)

49. A hydraulic turbine develops 1000 kW power for a head of 40 m. If the head is reduced to 20 m, the power developed (in kW) is

(a)177

(b) 354

(c) 500

(d) 707

Ans. (b)

50. Specific speed of a Kaplan turbine ranges between

(a)30 and 60

(b) 60 and 300

(c) 300 and 1000

(d) 1000 and 1500

Ans. (c)

51. A large hydraulic turbine is to generate 300 kW at 1000 rpm under a head of 40 m. For initial testing, a 1: 4 scale model of the turbine operates under a head of 10 m. The power generated by the model (in KW) will be: [GATE-2006; 1992]

(a) 2.34

(b) 4.68

(c) 9.38

(d) 18.75

Ans. (a)

52. Cavitation in a hydraulic turbine is most likely to occur at the turbine

(a) Entry

(b) Exit

(c) Stator exit

(d) Rotor exit

Ans. (b)

53. Match List-I (Phenomena-letters) with List-II (Causes-numbers) and select the correct answer:

A. Shock wave 1. Surface tension

B. Flow separation 2. Vapour pressure

C. Capillary rise 3. Compressibility

D. Cavitation 4. Adverse pressure gradient

Codes: A B C D A B C D

(a) 3 1 2 4

(b) 4 2 1 3

(c) 3 4 1 2

(d) 4 1 2 3

Ans. (c)

54. Of all the power plants, hydel is more disadvantageous when one compares the [IES-1996]

(a) Nearness to load centre

(b) Cost of energy resource

(c) Technical skill required

(d) Economics that determine the choice of plant.

Ans. (a)

55. Euler equation for water turbine is derived on the basis of [IES-1995]

(a) Conservation of mass

(b) Rate of change of linear momentum

(c) Rate of change of angular momentum

(d) Rate of change of velocity

Ans. (c)

56. If H is the head available for a hydraulic turbine, the power, speed and discharge, respectively are proportional to: [IES-2002]

(a)H1/2, H1/2, H3/2

(b) H3/2, H1/2, H1/2

(c) H1/2, H3/2, H1/2

(d) H1/2, H1/2, H

Ans. (b)

57. A Francis turbine is coupled to an alternator to generate electricity with a frequency of 50 Hz. If the alternator has 12 poles, then the turbine should be regulated to run at which one of the following constant speeds? [IES-2004]

(a) 250 rpm

(b) 500 rpm

(c) 600 rpm

(d) 1000 rpm

Ans. (b)

58. The gross head on a turbine is 300 m. The length of penstock supplying water from reservoir to the turbine is 400 m. The diameter of the penstock is 1 m and velocity of water through penstock is 5 m/s. If coefficient of friction is 0.0098, the net head on the turbine would be nearly,

(a) 310 m

(b) 295 m

(c) 200 m

(d) 150 m

Ans. (b)

59. Consider the following statements:

A water turbine governor

1. Helps in starting and shutting down the turbo unit

2. Controls the speed of turbine set to match it with the hydroelectric system

3. Sets the amount of load which a turbine unit has to carry Which of these statements are correct?

(a) 1, 2 and 3

(b) 1 and 2

(c) 2 and 3

(d) 1 and 3

Ans. (a)

60. In a reaction turbine,

(a) It is possible to regulate the flow without loss

(b) It must be placed at the foot of the fall and above the tail race

(c) Work done is purely by the change in the kinetic energy of the jet

(d) Only part of the head is converted into velocity before the water enters the wheel.

Ans. (d)

61. Which of the following hydraulic turbines are reaction turbines ? [IES-2011]

1. Francis

2. Kaplan

3. Propeller

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1 and 3 only

Ans. (a)

62. Match List-I with List-II and select the correct answer using the codes given below the lists: [IES-2009]

List-I

A. Pelton turbine

B. Francis turbine

C. Propeller turbine

D. Kaplan turbine

List-II

1. Specific speed from 300 to 1000 axial flow with fixed runner vanes

2. Specific speed from 10 to 50 Tangential flow

3. Specific speed from 60 to 300 mixed flow

4. Specific speed from 300 to 1000 axial flow with adjustable runner vanes

Codes: A B C D A B C D

(a) 2 1 3 4

(b) 4 1 3 2

(c) 2 3 1 4

(d) 4 3 1 2

Ans. (c)

63. Consider the following statements:

1. Pelton wheel is a tangential flow impulse turbine

2. Francis turbine is an axial flow reaction turbine

3. Kaplan turbine is a radial flow reaction turbine Which of the above statements is/ are correct?

(a) 1 and 3

(b) 1 alone

(c) 2 alone

(d) 3 alone

Ans. (b)

64. Which of the following types of turbine is/are suitable for tidal power plants?

1. Tubular turbine

2. Kaplan turbine

3. Bulb turbine

4. Francis turbine

65. Select the correct answer using the code given below:

(a) 1 only

(b) 1 and 3

(c) 2 and 4

(d) 4 only

Ans. (b)

66. Which one of the following turbines is used in underwater power stations? [IES-1998]

(a) Pelton turbine

(b) Deriaz turbine

(c) Tubular turbine

(d) Turgo-impulse turbine

Ans. (c)

67. Assertion (A): For the same power, the rotor of an impulse turbine need not be as large as that of a reaction turbine. Reason (R): In the case of a reaction turbine, water has to be admitted to the runner around its entire circumference.

(a) Both A and R are individually true and R is the correct explanation of A

(b) Both A and R are individually true but R is not the correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

Ans. (d)

68. A Pelton wheel is ideally suited for [IES-1998]

(a) High head and low discharge

(b) High head and high discharge

(c) Low head and low discharge

(d) Medium head and medium discharge

Ans. (a)

69. The maximum number of jets generally employed in an impulse turbine without jet interference is:

(a)4

(b) 6

(c) 8

(d) 12

Ans. (b)

70. The speed ratio of a Pelton wheel operating under a head of 900 m is 0.45. What is the peripheral velocity of the turbine wheel?

(a) 28 m/s

(b) 96 m/s

(c) 42 m/s

(d) 60 m/s

Ans. (d)

71. A Pelton wheel with single jet rotates at 600 rpm. The velocity of the jet from the nozzle is 100m/s. If the ratio of the vane velocity to jet velocity is 0.44, what is the diameter of the Pelton wheel?

(a) 0.7 m

(b) 1.4 m

(c) 2.1 m

(d) 2.8 m

Ans. (b)

72. What should be the ratio of blade speed of jet speed for the maximum efficiency of a Pelton wheel?

(a) 1:4

(b) 1:2

(c) 3:4

(d) 1

Ans. (b)

73. The overall efficiency of a Pelton turbine is 70 percentage. If the mechanical efficiency is 85 percentage, what is its hydraulic efficiency in percentage?

(a) 82.4%

(b) 59.5%

(c) 72.3%

(d) 81.5%

Ans. (a)

74. The gross head available to a hydraulic power plant is 100 m. The utilized head in the runner of the hydraulic turbine is 72 m. If the 'hydraulic efficiency of the turbine is 90 percentage, the pipe friction head is estimated to be: [IES-2000]

(a) 20 m

(b) 18 m

(c) 16.2 m

(d) 1.8 m

Ans. (a)

75. A reaction turbine discharges 30 m3/s of water under a head of 10 m with an overall efficiency of 92 percentage. The power developed is:

(a) 2952 kW

(b) 2870 kW

(c) 2760 kW

(d) 2652 kW

Ans. (c)

76. Which one of the following turbines exhibits a nearly constant efficiency over a 60% to 140% of design speed?

(a) Pelton turbine

(b) Francis turbine

(c) Deriaz turbine

(d) Kaplan turbine

Ans. (d)

77. When a hydraulic turbine is operated, it is found that it has high design efficiency and this efficiency remains constant over a wide range of regulation from the design condition. What is the type of this turbine?

(a) Pelton

(b) Francis

(c) Kaplan

(d) Propeller

Ans. (c)

78. In the case of Pelton turbine installed in a hydraulic power plant, the gross head available is the vertical distance between

(a) Forebay and tail race

(b) Reservoir level and turbine inlet

(c) Forebay and turbine inlet

(d) Reservoir level and tail race.

Ans. (b)

79. In a simple impulse turbine, the nozzle angle at the entrance is 30 degree. What is the blade-speed ratio (u/V) for maximum diagram efficiency?

(a) 0.25

(b) 0.5

(c) 0.433

(d) 0.866

Ans. (b)

80. Which one of the following is an example of a pure (100 percentage) reaction machine?

(a) Pelton wheel

(b) Francis turbine

(c) Modern gas turbine

(d) Lawn sprinkler

Ans. (d)

81. In which of the following hydraulic turbines, the efficiency would be affected most when the flow rate is changed from its design value?

(a) Pelton wheel

(b) Kaplan turbine

(c) Francis turbine

(d) Propeller turbine

Ans. (d)

82. Which one of the following is not correct regarding both Kaplan and propeller turbines?

(a) The runner is axial

(b) The blades are wing type

(c) There are four to eight blades

(d) The blades can be adjusted

Ans. (d)

83. Which one of the following is not correct regarding both Kaplan and propeller turbines?

(a) The runner is axial

(b) The blades are wing type

(c) There are four to eight blades

(d) The blades can be adjusted

Ans. (d)

84. Based on the direction of flow, which one of the following turbines is different from the other three?

(a) Pelton turbine

(b) Kaplan turbine

(c) De laval turbine

(d) Parson's turbine

Ans. (a)

85. Cavitation damage in the turbine runner occurs near the

(a) Inlet on the concave side of the blades

(b) Outlet on the concave side of the blades

(c) Outlet on the convex side of the blades

(d) Inlet on the convex side of the blades

Ans. (c)

86. What is the purpose of a surge tank in high head hydroelectric plants?

(a) To act as a temporary storage during load changes

(b) To improve the hydraulic efficiency

(c) To prevent surges in generator shaft speed

(d) To prevent water hammer due to sudden load changes

Ans. (d)

87. Which one of the following is the purpose of a surge tank in a Pelton Turbine station?

(a) It acts as a temporary storage during load change

(b) It prevents hydraulic jump

(c) It prevents surges at the transformer

(d) It prevents water hammer due to sudden reduction in load

Ans. (d)

88. In hydraulic power-generation systems, surge tanks are provided to prevent immediate damage to:

(a) Draft tube

(b) Turbine

(c) Tail race

(d) Penstocks

Ans. (d)

89. The location of a surge tank in a high head hydraulic power plant would be:

(a) Nearer to the dam

(b) At the powerhouse

(c) Nearest to the powerhouse

(d) Immaterial

Ans. (c)

90. When the speed of a centrifugal pump is doubled, the power required to drive the pump will:

(a) Increase 8 times

(b) Increase 4 times

(c) Double

(d) Remain the same

Ans. (a)

91. Power input required is given by:

(a)1.66 kW

(b) 1.066 kW

(c) 2.12 kW

(d) 20 kW

Ans. (a)

92. The runaway speed of a hydraulic turbine is the speed

(A) At full load

(B) At which there will be no damage to the runner

(C) Corresponding to maximum overload permissible

(D) At which the turbine will run freely without load

Answer: D

93. High specific speed of a pump implies it is

(A) Centrifugal pump

(B) Mixed flow pump

(C) Axial flow pump

(D) Any one of the above

Answer: C

94. The specific speed of a turbine is the speed of an imaginary turbine, identical with the given turbine, which

(A) Delivers unit discharge under unit head

(B) Delivers unit discharge under unit speed

(C) Develops unit power under unit head

(D) Develops unit power under unit speed

Answer: C

95. Francis, Kaplan and propeller turbines fall under the category of

(A) Impulse turbines

(B) Reaction turbines

(C) Axial flow turbines

(D) Mixed flow turbines

Answer: B

96. Which of the following is not a reaction turbine?

(A) Fourneyron turbine

(B) Journal turbine

(C) Thomson's turbine

(D) Pelton wheel

Answer: D

97. A turbine develops 10000 kW under a head of 25 meters at 135 r.p.m. Its specific speed is

(A) 175.4 r.p.m.

(B) 215.5 r.p.m.

(C) 241.5 r.p.m.

(D) 275.4 r.p.m

Answer: C

98. According to fan laws, for the fans having constant wheel diameters, the power demand varies

(A) Directly as fan speed

(B) Square of fan speed

(C) Cube of fan speed

(D) Square root of fan speed

Answer: C

99. According to fan laws, at constant weight of air or gas, the speed, capacity and pressure vary

(A) Directly as the air or gas density

(B) Inversely as square root of density

(C) Inversely as density

(D) As square of density

Answer: C

100. As water flows through the runner of a reaction turbine, pressure acting on it would vary from:

(a) More than atmospheric pressure to vacuum

(b) Less than atmospheric pressure to zero gauge pressure

(c) Atmospheric pressure to more than atmospheric pressure

(d) Atmospheric pressure to vacuum

Ans. (a)

101. Which of the following advantages is/are possessed by a Kaplan turbine over a Francis turbine?

1. Low frictional losses.

2. Part load efficiency is considerably high.

3. More compact and smaller in size.

Select the correct answer using the codes given below

(a) Only 1

(b) Only 1 and 2

(c) Only 2 and 3

(d) 1, 2 and 3

Ans. (d)

102. A Francis turbine working at 400 rpm has a unit speed of 50 rpm and develops 500 kW of power. What is the effective head under which this turbine operates?

(a) 62.5 m

(b) 64.0 m

(c) 40.0 m

(d) 100 m

Ans. (b)

103. An adjustable blade propeller turbine is called as

(a) Banki turbine

(b) Pelton turbine

(c) Kaplan turbine

(d) Francis-Pelton turbine

Ans. (c)

104. A Kaplan turbine is a

(a) Outward flow reaction turbine

(b) Inward flow impulse turbine

(c) Low head axial flow turbine

(d) High head mixed flow turbine

Ans. (c)

105. Consider the following statements in respect of Kaplan Turbine:

1. It is a reaction turbine.

2. It is a mixed flow turbine.

3. It has adjustable blades.

Which of the statements given above are correct?

(a) 1, 2 and 3

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1 and 2 only

Ans. (c)

106. Assertion (A): A Kaplan turbine is an axial flow reaction turbine with its vanes fixed to the hub.Reason (R): Water flows parallel to the axis of rotation of the turbine and a part of the pressure energy gets converted to kinetic energy during its flow through the vanes.

(a) Both A and R are individually true and R is the correct explanation of A

(b) Both A and R are individually true but R is not the correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

Ans. (d)

107. When a hydraulic turbine is operated, it is found that it has high design efficiency and this efficiency remains constant over a wide range of regulation from the design condition. The turbine is

(a) Francis turbine

(b) Propeller turbine

(c) Pelton turbine

(d) Kaplan turbine

Ans. (d)

108. What is the range of the speed ratio for Kaplan turbine for its most efficient operation?

(a) 0.10 to 0.30

(b) 0.43 to 065

(c) 085 to 120

(d) 1.40 to 200

Ans. (d)

109. The use of a draft tube in a reaction type water turbine helps to:

(a) Prevent air from entering

(b) Increase the flow rate

(c) Convert the kinetic energy to pressure energy

(d) Eliminate eddies in the downstream

Ans. (c)

110. Consider the following statements regarding a draft tube used in water turbines:

1. It reduces the discharge velocity of water to minimize the loss of kinetic energy at the outlet.

2. It permits the turbine to be set above the tail race without any appreciable drop in available head.

3. It is used in both impulse and reaction type of water turbines.

Which of the above statements is/are correct?

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1 only

Ans. (b)

111. The level of runner exit is 5 m above the tail race, and atmospheric pressure is 10.3 m. The pressure at the exit of the runner for a divergent draft tube can be:

(a) 5 m

(b) 5.3 m

(c) 10 m

(d) 10.3 m

Ans. (b)

112. Which of the following water turbines does not require a draft tube?

(a) Propeller turbine

(b) Pelton turbine

(c) Kaplan turbine

(d) Francis turbine

Ans. (b)

113. Consider the following statements:

1. A draft tube may be fitted to the tail end of a Pelton turbine to increase the available head.

2. Kaplan turbine is an axial flow reaction turbine with adjustable vanes on the hub.

3. Modern Francis turbine is a mixed flow reaction turbine.

Which of these statements are correct?

(a) 1, 2 and 3

(b) 1 and 2

(c) 2 and 3

(d) 1 and 3

Ans. (c)

114. Which one of the following forms of draft tube will NOT improve the hydraulic efficiency of the turbine?

(a) Straight cylindrical

(b) Conical type

(c) Bell-mouthed

(d) Bent tube

Ans. (a)

115. A hydraulic power station has the fol1owing major items in the hydraulic circuit:

1. Draft tube

2. Runner

3. Guide wheel

4. Penstock

5. Scroll case

The correct sequence of these items in the direction of flow is:

(a) 4,2,3,1,5

(b) 4,3,2,5,1

(c) 1,2,3,5,4

(d) 1,3,24,5

Ans. (b)

116. The movable wicket gates of a reaction turbine are used to:

(a) Control the flow of water passing through the turbine.

(b) Control the pressure under which the turbine is working.

(c) Strengthen the casing of the turbine

(d) Reduce the size of the turbine.

Ans. (a)

117. A hydraulic reaction turbine working under a head of 16 m develops 640 kW of power. What is the unit power of the turbine?

(a) 10 kW

(b) 40 kW

(c) 60 kW

(d) 160 kW

Ans. (a)

118. Consider the following statements pertaining to specific speed of turbo machines:

1. Specific speed varies with shape of the runner and other parts of the machine.

2. Machines with higher specific speeds are limited to low heads.

3. Specific speed is dimensionless and is independent of variation of type of fluid used.

Which of the statements given above are correct?

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1 and 3 only

Ans. (b)

119. The specific speed of a hydraulic turbine depends upon

(a) speed and power developed

(b) discharge and power developed

(c) speed and head of water

(d) speed, power developed and head of water

Ans. (d)

120. Assertion (A): For higher specific speeds, radial flow type pumps have the greatest efficiency. Reason (R): Pumps having larger discharge under smaller heads have higher specific speeds.

(a) Both A and R are individually true and R is the correct explanation of A

(b) Both A and R are individually true but R is not the correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

Ans. (a)

121. The specific speed of a turbine is defined as the speed of a member of the same homologous series of a such a size that it

(a) Delivers unit discharge at unit head.

(b) Delivers unit discharge at unit power.

(c) Delivers unit power at unit discharge.

(d) Produces unit power under a unit head.

Ans. (d)

122. Which one of the following is the correct statement?
Specific speed of a fluid machine

(a) Refers to the speed of a machine of unit dimensions.

(b) Is a type-number representative of its performance?

(c) Is specific to the particular machine.

(d) Depends only upon the head under which the machine operates.

Ans. (c)

123. An impulse turbine operating with a single nozzle has a specific speed of 5. What will be the approximate specific speed of the turbine if the turbine is operated with one more additional nozzle of the same size?

(a) 4

(b) 6

(c) 7

(d) 10

Ans. (c)

124. Two Pelton wheels A and B have the same specific speed and are working under the same head. Wheel A produces 400 kW at 1000 rpm. If B produces 100 kW, then its rpm is:

(a) 4000

(b) 2000

(c) 1500

(d) 1250

Ans. (b)

125. Assertion (A): The specific speed of a Pelton turbine is low. Reason (R): Pelton turbine works under a high head and handles low discharge.

(a) Both A and R are individually true and R is the correct explanation of A

(b) Both A and R are individually true but R is not the correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

Ans. (b)

126. Consider the following turbines/wheels

1. Francis turbine

2. Pelton wheel with two or more jets

3. Pelton wheel with a single jet

4. Kaplan turbine

The correct sequence of these turbines/wheels in increasing order of their specific speeds is:

(a) 2, 3, 1, 4

(b) 3, 2, 1, 4

(c) 2, 3, 4, 1

(d) 3, 2, 4, 1

Ans. (b)

127. If the full-scale turbine is required to work under a head of 30 m and to run at 428 r.p.m., then a quarter-scale turbine model tested under a head of 10 m must run at:

(a) 143 r.p.m.

(b) 341 r.p.m.

(c) 428 r.p.m.

(d) 988 r.p.m.

Ans. (d)

128. A centrifugal pump operating at 1000 rpm develops a head of 30 m. If the speed is increased to 2000 rpm and the pump operates with the same efficiency, what is the head developed by the pump?

(a) 60 m

(b) 90 m

(c) 120 m

(d) 150 m

Ans. (c)

129. Which one of the following statements is not correct in respect of hydraulic turbines?

(a) (Speed) is proportional to (1/Diameter)

(b) (Power) is proportional to (Speed)3

(c) (Power) is proportional to (Head)3/2

(d) (Speed) is proportional to (Head)1/2

Ans. (a)

130. Assertion (A): Runaway speed of a turbine is the speed under maximum head at full gate opening when the load is disconnected suddenly.
Reason (R): The various rotating components of the turbine are designed to remain safe at the runaway speed.

(a) Both A and R are individually true and R is the correct explanation of A

(b) Both A and R are individually true but R is not the correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

Ans. (b)

131. In fluid machinery, the relationship between saturation temperature and pressure decides the process of
(a) Flow separation

(b) Turbulent mixing

(c) Cavitation

(d) Water hammer

Ans. (c)

132. Chances of occurrence of cavitation are high if the
(a) Local pressure becomes very high

(b) Local temperature becomes low

(c) Thoma cavitation parameter exceeds a certain limit

(d) Local pressure falls below the vapour pressure

Ans. (d)

133. Consider the following statements: Cavitation in hydraulic machines occurs at the
1. Exit of a pump

2. Entry of the pump

3. Exit of a turbine Of these correct statements are:

(a) 1 and 2

(b) 1 and 3

(c) 1, 2 and 3

(d) 2 and 3

Ans. (d)

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01. in turbulent flow the velocity
A. varies with time and space
B. varies with time only, the patterns of fluctuation, with respect to time, being same at all points.
C. is constant at every point.
D. None of the above.
ANSWER: B

02. In a turbulent flow the shear stress is mainly due to the
A. Density of the fluid.
B. Dynamic viscosity of the fluid.
C. Eddy viscosity of the fluid.
D. All of the above.
ANSWER: D

03. For which of the following flows Blasius equation is used?
A. Laminar flow
B. Turbulent flow in rough pipes.
C. Turbulent flow in smooth pipes for any Reynolds number
D. Turbulent flow in smooth pipes for any $Re < 10^5$
ANSWER: D

04. In turbulent flow, which of the following gives the exact velocity distribution?
A. Logarithmic distribution
B. Blasius equation
C. Power law with index varying
D. Prandtl's one-seventh power.
ANSWER: A

05. The boundary layer exists in which of the following?
A. Flow of real fluids.
B. Flow of ideal fluids.
C. Flow over flat surfaces only
D. Pipe flow only
ANSWER: A

06. On account of which of the following boundary layer exists?
A. Surface tension
B. Gravitational effect
C. Viscosity of fluid
D. None of the above.
ANSWER: C

07. On account of which of the following L.Prandtl is regarded as the father of modern fluid mechanics?
A. His pioneering research on flow of low-viscosity fluids bringing forward a new concept in boundary layer
B. His new interpretations on fluid resistance.
C. His fundamental research in the field of aircraft engineering.
D. None of the above.
ANSWER: A

08. The displacement thickness is
A. The layer in which the loss of energy is minimum.
B. The layer which represents reduction in momentum caused by the boundary layer.
C. The thickness up to which the velocity approaches 99% of the free-stream velocity.
D. The distance measured perpendicular to the boundary by which the free-stream is displaced on account of formation of boundary layer.
ANSWER: D

09. Over a long flat plate, the laminar boundary-layer becomes unstable and changes flow characteristics from laminar to turbulent when the plate Reynold's number approaches a value between
A. 3×10^4 to 5×10^4
B. 3×10^5 to 6×10^5
C. 2×10^6 to 5×10^6
D. 5×10^6 to 8×10^6
ANSWER: B

10. When the fluid flows along the solid boundary more and more fluid gets retarded in the vicinity of the boundary, this deceleration is due to
A. high velocity of the fluid
B. high velocity flow outside the boundary layer
C. high velocity gradients which exist at and near the boundary
D. None of the above.
ANSWER: C

11. Momentum thickness is given by which of the following relations
A. $\int_0^{\delta} (1-u/U)dy$
B. $\int_0^{\delta} u/U(1-u/U)dy$
C. $\int_0^{\delta} u^2/U^2 (1-u/U)dy$
D. None of the above
ANSWER: B

12. The boundary layer separation occurs when
A. $(dp/dx) < 0$
B. $(\delta u/ \delta y)_{y=0} = 0$
C. $(\delta u/ \delta y)_{y=0} > 0$

D. None of the above
ANSWER: B

13. Which of the following is the condition for detached flow
A. $(\delta u/ \delta y)_{y=0} = 0$
B. $(\delta u/ \delta y)_{y=0} > 0$
C. $(\delta u/ \delta y)_{y=0} < 0$
D. None of the above
ANSWER: C

14. Von Karman momentum integral equation is applicable to
A. laminar boundary layer flow only
B. turbulent boundary layer flow only
C. transition boundary layer flow only
D. laminar, turbulent and transition boundary layer flows
ANSWER: D

15. If the Reynolds number is more than 5×10^5 the boundary layer is called
A. laminar boundary layer
B. turbulent boundary layer
C. either of the above
D. None of the above
ANSWER: B

16. The separation of boundary can be prevented by
A. providing small divergence in a diffuser
B. providing a trip wire ring in the laminar region of the flow over a sphere
C. providing a bypass in the slotted wing
D. suction of the slow moving fluid by a suction slot
E. all of the above
ANSWER: E

17. The ratio of mean velocity to the maximum velocity in a pipe depends on which of the following factors
A. Reynolds number of flow
B. The pressure drop in the pipe
C. the friction factor
D. the density of fluid
E. all of the above
ANSWER: E

18. The critical value of Reynolds number at which boundary layer changes from laminar to turbulent depends on which of the following
A. Turbulence in ambient flow
B. surface roughness
C. pressure gradient

D. plate curvature
E. all of the above
ANSWER: E

19. ____ thickness is the distance through which the total loss of momentum per second is equal to if it were passing a stationary plate.
A. displacement
B. Momentum
C. Energy
D. None of the above
ANSWER: B

20. Ageing of pipes implies which of the following
A. A decrease in the value of friction factor
B. Increase in absolute roughness linearly with time and hence friction factor
C. Pipe becoming smoother with time
D. None of the above
ANSWER: B

21. The pressure drag depends upon
A. the characteristics of the oncoming flow
B. the boundary layer formation
C. the separation of the boundary layer and the size of the wake
D. the shear stresses generated on the body surface
ANSWER: C

22. In case of airfoils, the profile drag is one which is caused by
A. the compressibility effects
B. the shape and orientation of the airfoil
C. the circulation induced around the airfoil
D. none of the above
ANSWER: B

23. The friction drag is primarily due to
A. separation of the boundary layer
B. weight component in the direction of flow
C. shear stresses generated due to viscous action
D. none of the above
ANSWER: C

24. For a perfectly streamlined body which of the following statements is incorrect?
A. the pressure drag is very small
B. the boundary layer remains thin over the entire surface and does not separate
C. the flow separation points and a wake region is formed
D. none of the above
ANSWER: C

25. The drag force is given by
A. $C_D\rho U^2A$
B. $C_D\rho^2U^2A$
C. $C_D\rho U^2A^2$
D. $C_D(\rho U^2/2)A^2$
ANSWER: D

26. The shape of a streamlined body is such as to
A. fixes the separation points as much ahead as possible
B. shift the boundary layer separation to the rearmost part thereby considerably reducing the wake size
C. makes the streamline pattern symmetrical
D. none of the above
ANSWER: B

27. Which of the following statements is correct for bluff bodies?
A. the total drag is considerably larger as compared to that for streamlined bodies
B. the friction drag is greater than the pressure drag
C. the total drag is much less as compared to that for streamlined bodies
D. none of the above
ANSWER: A

28. The drag force experienced by an object is
A. the component of resultant fluid dynamic force in the flow direction
B. the horizontal force due to pressure variation over the surface of the object
C. the resultant fluid dynamics force acting on the object
D. none of the above
ANSWER: A

29. The drag and lift forces experienced by an object placed in a fluid stream are due to
A. pressure and turbulence
B. viscosity and turbulence
C. pressure and viscosity
D. pressure and gravity
ANSWER: C

30. The lift force that may act on an object is
A. the component force due to the fluid displaced by the body
B. the component of resultant fluid dynamic force in a direction normal to the general direction of flow
C. the force due to shear stress that acts on the body surface
D. none of the above
ANSWER: B

31. Whcih of the following conditions/requirements is necessary to induce lift on an object

A. the object should be so shaped that there are zones if high and low velocities resulting in pressure difference between upper side and bottom side of the object
B. the object should be designed that pressure distribution over its surface is symmetrical
C. the shape of the object should be symmetrical and the axis of the symmetry be aligned parallel to the flow direction
D. none of the above
ANSWER: A

32. A streamlined body is defined as a body about which
A. a drag is zero
B. the flow is laminar
C. the flow is along streamlines
D. the flow separation is suppressed
ANSWER: D

33. When a circular cylinder is rotated in a uniform flow, a lift force is produced on the cylinder which is caused by
A. the pressure difference between the two halves, the bottom-half being subjected to a higher pressure
B. the symmetrical streamlines patterns
C. the shear stresses due to viscous action
D. none of the above
ANSWER: A

34. For a single stagnation point, the condition is
A. $\Gamma = 4\pi U R$
B. $\Gamma = 2\pi U R$
C. $\Gamma = 4\pi U^2 R$
D. $\Gamma = 4\pi U R^2$
ANSWER: A

35. The expression for coefficient of lift for an airfoil is given by
A. $C_L = 2\pi \sin^2\alpha$
B. $C_L = 4\pi \sin\alpha$
C. $C_L = 2\pi \sin \alpha$
D. none of the above
ANSWER: C

36. The expression for lift coefficient for a rotating cylinder in a uniform flow is given by
A. $C_L = \Gamma / R^2 U$
B. $C_L = \Gamma / R U^2$
C. $C_L = \Gamma/RU$
D. none of the above
ANSWER: C

37. The velocity of ideal fluid at any point on the surface of the cylinder is given by

A. U sinθ
B. 2U sinθ
C. 3U sinθ
D. 4U sinθ
ANSWER: B

38. The drag on a sphere for Reynolds number less than 0.2 is given by
A. πμDU
B.2πμDU
C.3πμDU
D. none of the above
ANSWER: C

39. The mathematical expression for lift force is given by
A. $F_L = C_L \rho A U$
B. $F_L = C_L (\rho U^2/2) A$
C. $F_L = C_L \rho A U^2 A$
D. none of the above
ANSWER: B

40. The lift force on an airfoil is due to
A. the circulation of air around it
B. the pressure difference of the top and bottom surface
C. the formation of tip vortices
D. the angle of attack
ANSWER: A

41. The terminal velocity of the small sphere settling in a viscous fluid varies as
A. the Reynolds number
B. the square of its diameter
C. directly proportional to the viscosity of the fluid
D. its diameter
ANSWER: B

42. at the stall point for the airfoil
A. the boundary layer separates at the leading edge
B. the lift is maximum and the drag is minimum
C. the lift is zero and the drag is maximum
D. the lift is maximum and the drag increases sharply beyond it
ANSWER: D

43. The velocity at the top of spinning ball is
A. less than that at the bottom
B. greater than that at the bottom
C. equal to that at the bottom
D. independent of spinning

ANSWER: B

44. The circulation around an airfoil required for lift is produced
A. when the airfoil is kept inclined to flow direction
B. due to tip vortices
C. by rotation of airfoil
D. because of surface discontinuity formed at the trailing edge
ANSWER: B

45. The terminal velocity of a body in a stationary mass of fluid corresponds to the situation when the
A. body acquires a constant velocity in any direction
B. net force acting on the body equals zero
C. weight of the body equals the buoyancy force acting on it
D. net force acting on the body acts in vertical direction
ANSWER: B

1. Flow separation is caused by
   (a) Reduction of pressure to local vapour pressure
   (b) A negative pressure gradient
   (c) A positive pressure gradient
   (d) Thinning of boundary layer thickness to zero.

Ans. (c)

2. A fluid flowing over a flat plate has the following properties:Dynamic viscosity: 25 × 10-6 kg/ms , Specific heat: 2.0 kJ/kgK Thermal conductivity: 0.05 W/mk The hydrodynamic boundary layer thickness is measured to be 0.5 mm.The thickness of thermal boundary layer would be:

(a) 0.1 mm (b) 0.5 mm (c) 1.0 mm (d) None of the above
Ans. (b)

3. For flow of fluid over a heated plate, the following fluid properties are known: viscosity = 0.001 poise ; specific heat at constant pressure = 1*kJ/kg.K;* thermal conductivity = 1 *W/m.K*. The hydrodynamic boundary layer thickness at a specified location on the plate is 1 mm. The thermal boundary layer thickness at the same location is:

(a)0.001 mm (b) 0.01 mm (c) 1 mm (d) 1000 mm
Ans. (c)

4. Boundary layer is defined as

(a) A thin layer at the surface where gradients of both velocity and temperature are small
(b) A thin layer at the surface where velocity and velocity gradients are large
(c) A thick layer at the surface where velocity and temperature gradients are large

(d) A thin layer at the surface where gradients of both velocity and temperature are large
Ans. (b)

5. In the boundary layer, the flow is:

(a)Viscous and rotational (b) Inviscid and irrotational
(c)Inviscid and rotational (d) Viscous and irrotational
Ans. (a)

6. Assertion (A): In the boundary layer concept, the shear stress at the outer edge of the layer is considered to be zero.

Reason (R): Local velocity is almost equal to velocity in potential flow.

(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false but R is true

Ans. (a)

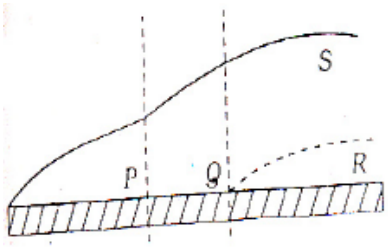
7. In the region of the boundary layer nearest to the wall where velocity is not equal to zero, the viscous forces are
   (a) Of the same order of magnitude as the inertial forces
   (b) More than inertial forces
   (c) Less than inertial forces
   (d) Negligible

Ans. (c)

8. The critical value of Reynolds number for transition from laminar to turbulent boundary layer in external flows is taken as:

(a)2300 (b) 4000 (c) 5×10^5 (d) 3×10^6
Ans. (c)

9. The development of boundary layer zones labeled P, Q, R and S over a flat plate is shown in the given figure. Based on this figure, match List-I (Boundary layer zones) with



List-II(Type of boundary layer) and select the correct answer:

List-I A-P B-Q C-R D-S
List-II 1. Transitional 2. Laminar viscous sub-layer 3. Laminar 4. Turbulent
Codes: A B C D

(a) 3 1 2 4
(b) 3 2 1 4
(c) 4 2 1 3
(d) 4 1 2 3

Ans. (a)

10. The transition Reynolds number for flow over a flat plate is 5 × 105. What is the distance from the leading edge at which transition will occur for flow of water with a uniform velocity of 1 m/s? [For water, the kinematic viscosity, ν = 0.858 × 10- 6 m2/s

(a)1 m (b) 0.43 m (c) 43 m (d) 103 m

Ans. (b)

11. The 'velocity defect law' is so named because it governs a
    (a) Reverse flow region near a wall
    (b) Slip-stream flow at low pressure
    (c) Flow with a logarithmic velocity profile a little away from the wall
    (d) Re-circulating flow near a wall

Ans. (c)

12. The predominant forces acting on an element of fluid in the boundary layer over a flat plate placed in a uniform stream include
    a. Inertia and pressure forces (b) Viscous and pressure forces
    b. Viscous and body forces (d) Viscous and inertia forces

Ans. (d) .

13. The hydrodynamic boundary layer thickness is defined as the distance from the surface where the
    (a) Velocity equals the local external velocity
    (b) Velocity equals the approach velocity
    (c) Momentum equals 99% of the momentum of the free stream
    (d) Velocity equals 99% of the local external velocity

Ans. (d)

14. Assertion (A): The thickness of boundary layer is an ever increasing one as its distance from the leading edge of the plate increases.
    (a) Reason (R): In practice, 99% of the depth of the boundary layer is attained within a short distance of the leading edge.
    (b) Both A and R are individually true and R is the correct explanation of A
    (c) Both A and R are individually true but R is not the correct explanation of A
    (d) A is true but R is false
    (e) A is false but R is true

Ans. (c)

15. For the velocity profile u / u = _, the momentum thickness of a laminar boundary layer on a flat plate at a distance of 1 m from leading edge for air (kinematic viscosity = 2 × 10–5 m2/s) flowing at a free stream velocity of 2 m/s is given by

(a)3.16 mm (b) 2.1 mm (c) 3.16 m (d) 2.1 m

Ans. (b)

16. A flat plate, 2m × 0.4m is set parallel to a uniform stream of air (density 1.2kg/m3 and viscosity 16 centistokes) with its shorter edges along the flow. The air velocity is 30 km/h. What is the approximate estimated thickness of boundary layer at the downstream end of the plate?

(a)1.96 mm (b) 4.38 mm (c) 13.12 mm (d) 9.51 mm

Ans. (b)

17. A laminar boundary layer occurs over a flat plate at zero incidences to the flow. The thickness of boundary layer at a section 2 m from the leading edge is 2 mm. The thickness of boundary layer at a section 4 m from the leading edge will be:

(a)$2 \times (2)^2$ mm (b) $2 \times (2)^{1/2}$ mm (c) $2 \times (2)^{4/5}$ mm (d) $2 \times (2)^{1/5}$ mm

Ans. (b)

18. For linear distribution of velocity in the boundary layer on a flat plate, what is the ratio of displacement thickness (δ*) to the boundary layer thickness (δ)?

(a) 0.25 (b)0.3333 (c) 0.5 (d) 1.5

Ans. (c)

19. Given that δ = boundary layer thickness, δ * = displacement thickness

δ_e= energy thickness θ = momentum thickness

The shape factor H of a boundary layer is given by

(a) $H = \delta_e/\delta$ (b) $H = \delta^*/\theta$ (c) $H = \delta/\theta$ (d) $H = \delta^*/\delta$

Ans. (b) Shape factor = Displacement thickness/Momentum thickness

20. The velocity distribution in the boundary layer is given as u / us = y / δ, where u is the velocity at a distance y from the boundary, us is the free stream velocity and δ is the boundary layer thickness at a certain distance from the leading edge of a plate. The ratio of displacement to momentum thicknesses is

(a) 5 (b) 4 (c) 3 (d) 2

Ans. (c).

21. The velocity profile in a laminar boundary layer is given by u/U = y/ δ.The ratio of momentum thickness to displacement thickness for the boundary is given by which one of the following?

(a) 2 : 3 (b) 1 : 2 (c) 1 : 6 (d) 1 : 3

Ans. (d)

22. Which one of the following is the correct relationship between the boundary layer thickness δ , displacement thickness δ * and the momentum thickness θ?

(a) $\delta > \delta^* > \theta$ (b) $\delta^* > \theta > \delta$ (c) $\theta > \delta > \delta^*$ (d) $\theta > \delta^* > \delta$

Ans. (a)

23. According to Blasius law, the local skin friction coefficient in the boundary-layer over a flat plate is given by:

(a) $0.332/ R_e^{0.5}$ (b) $0.664/ R_e^{0.5}$ (c) $0.647/ R_e^{0.5}$ (d) $1.328/ R_e^{0.5}$

Ans. (b)

24. The equation of the velocity distribution over a plate is given by u = 2y – y2 where u is the velocity in m/s at a point y meter from the plate measured perpendicularly. Assuming μ = 8.60 poise, the shear stress at a point 15 cm from the boundary is

(a)1.72 N/m^2 (b) 1.46 N/m^2 (c) 14.62 N/m^2 (d) 17.20 N/m^2

Ans. (b)

25. For laminar flow over a flat plate, the thickness of the boundary layer at a distance from the leading edge is found to be 5 mm. The thickness of the boundary layer at a downstream section, which is at twice the distance of the previous section from the leading edge will be

(a) 10 mm (b) 5 √2 mm (c) 5.2 mm (d) 2.5 mm

Ans. (b)

26. The laminar boundary layer thickness, δ at any point x for flow over a flat plate is given by δ / x

(a) $0.664/\sqrt{Re_X}$ (b) $1.328/\sqrt{Re_X}$ (c) $1.75/\sqrt{Re_x}$ (d) $5.0/\sqrt{Re_x}$

Ans. (d)

27. For turbulent boundary layer low, the thickness of laminar sub layer 'δ' is given by:

(a) v / u* (b) 5 v / u* (c) 5.75 log v / u* (d) 2300 v / u*

Ans. (b)

28. Assertion (A): The 'dimples' on a golf ball are intentionally provided.
Reason (R): A turbulent boundary layer, since it has more momentum than a laminar boundary layer, can better resist an adverse pressure gradient.

(a) Both A and R are individually true and R is the correct explanation of A.
(b) Both A and R are individually true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

Ans. (a)

29. The boundary layer flow separates from the surface if

(a) du/dy = 0 and dp/dx = 0 (b) du/dy = 0 and dp/dx > 0
(c) du/dy = 0 and dp/dx < 0 (d) The boundary layer thickness is zero

Ans. (b)

30. In a boundary layer developed along the flow, the pressure decreases in the downstream direction. The boundary layer thickness would:

(a) Tend to decrease (b) Remain constant (c) Increase rapidly (d) Increase gradually
Ans. (d)

31. Flow separation in a flow past a solid object is caused by
    (A) A reduction of pressure to vapor pressure (B) A negative pressure gradient
    (C) A positive pressure gradient (D) The boundary layer thickness reducing to zero

Ans B

32. If x is the distance measured from the leading edge of a flat plate, then laminar boundary layer thickness varies as
    (A) 1/x (B) $x^{4/5}$ (C) x^2 (D) $x^{1/2}$

Ans D

33. Consider a laminar boundary layer over a heated flat plate. The free stream velocity is. At some distance x from the leading edge the velocity boundary layer thickness is δ_v and the thermal boundary layer thickness is δ_T. If the prandtl number is greater than 1, then
    (A) $\delta_v > \delta_T$ (B) $\delta_T > \delta_v$ (C) $\delta_v \approx \delta_T \sim (U_\infty x)^{-1/2}$ (D)) $\delta_v \approx \delta \sim x^{1/2}$
    Ans A

34. For air flow over a plate, velocity (U) and boundary layer thickness(δ) can be expressed respectively, as

$$\frac{U}{U_\infty} = \frac{3}{2}\frac{y}{\delta} - \frac{1}{2}\left(\frac{y}{\delta}\right)^3 \quad ; \quad \delta = \frac{4064x}{\sqrt{Re_x}}$$

If the free steam velocity is 2 m/s, and air has kinematic viscosity of 1.5×10^{-5} and density of 1.23 kg/m^{3}then wall shear stress at x=1m, is

(A) 2.36×10^{-2} N/m^2 (B) 43.6×10^{-2} N/m^3 (C) 4.36×10^{-2} N/m^4 (D) 2.18×10^{-5} N/m^2

Ans C

35. A model of a hydraulic turbine is tested at head of 1/4th of that under which the full scale turbine works. The diameter of the model is half of that of the full scale turbine. If N is the RPM of the full scale turbine, the RPM of the model will be
    (A) N/4 (B) N/2 (C) N (D) 2N
    Ans C

36. Consider an incompressible laminar boundary layer flow over a flat plate of length of L, aligned with the direction of an oncoming uniform free stream. If F is the ratio of the drag force on the front half of the plate to the drag force on the rear half, then
    (A) $F < l/2$ (B) $F = l/2$ (C) $F = l$ (D) $F > l$

a. Ans D

37. Match the following

38. P : Compressible flow	39. U : Reynolds number
40. Q : Free surface flow	41. V : Nusselt number
42. R : Boundary layer flow	43. W : Webber number
44. S : Pipe flow	45. X ; Froude number
46. T : Heat Convection	47. Y : Match number
48.	49. Z : Skin friction coefficient

(A) P-U ; Q-X ; R-V ;S-Z ; T-W (B) P-W ; Q-X ; R-Z ; S-U; T-V
(C) P-Y ; Q-W ; R-Z ; S-U ; T-X (D) P-Y ; Q-W ; R-Z ; S-U ; T-V

Ans D

50. An incompressible fluid flows over a flat with zero pressure gradients. The boundary layer thickness is 1mm at a location where the Reynolds number is 1000. If the velocity of the fluid alone is increased by a factor 4, then boundary layer thickness at the same location, in mm will be
(A) 4 (B) 2 (C) 0.5 (D) 0.25

Ans C

51. The concept of hydrodynamic boundary layer was first suggested by
a) Isaac Newton b) Ludwig Prandtl c) Rodridge d) Fourier
Answer: b

52. The free stream undisturbed flow has a uniform velocity $U_{INFINITY}$ in the
a) X-direction b) Y-direction c) Z-direction d) Any direction
Answer: a

53. The thin layer where velocity changes continuously is called
a) Differential layer b) Thermal boundary layer c) Hydrodynamic boundary layer
d) Velocity distribution layer

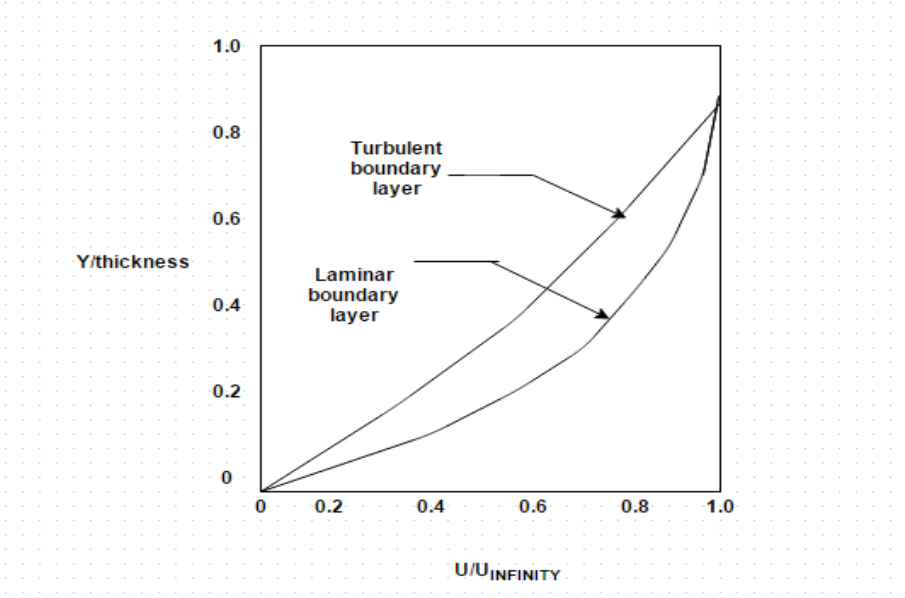
Answer: c

54. The conditions for flow beyond the boundary layer and its outer edge are
a) d u/d y = 0 and $u = U_0$ b) d u/d y = Infinity and $u = U_{INFINITY}$
c) d u/d y = 1 and $u = U_0$ d) d u/d y = 0 and $u = U_{INFINITY}$
Answer: d

55. The pattern of flow in the boundary layer is judged by the
a) Reynolds number
b) Fourier number
c) Peclet number

d) Grashof number
Answer: a

56. Consider the diagram given below and identify the correct option



a) The velocity gradient is zero everywhere
b) The velocity profile changes at every instant of time
c) Boundary layers from the pipe walls meet the pipe anywhere
d) Thickness of the boundary layer is limited to the pipe radius
Answer: d

57. The transition from laminar to turbulent pattern of flow occurs at values of Reynolds number between
a) 1000-2000
b) 300000-500000
c) 500000-700000
d) 35750-45678
Answer: b
.

58. The entrance length required for the flow to become fully-developed turbulent flow is dependent on

(i) Surface finish (ii) Downstream conditions (iii) Fluid properties

Identify the correct answer

a) 2 and 3 b) 1 and 3 c) 1, 2 and 3 d) 1 and 2

Answer: c

59. What is the value of thickness of the boundary layer at leading edge of the plate?
a) 0.33 b) 1 c) 0.5 d) 0

Answer: d

60. The boundary layer thickness is taken to be at a distance from the plate surface to a point at which the velocity is given by
a) $u = 0.99\ U_{INFINITY}$ b) $u = 0.75\ U_{INFINITY}$ c) $u = 0.50\ U_{INFINITY}$ d) $u = 0.33\ U_{INFINITY}$
Answer: a

61. Glycerin at 10 degree Celsius flows past a flat plate at 20 m/s. Workout the velocity components at a point P(x, y) in the fluid flow where x = 2 m from the leading edge of the plate y = 5 cm from the plate surface For glycerin at 10 degree Celsius, kinematic viscosity = $2.79 * 10^{-3}\ m^2/s$
a) 15.92 m/s and 0.0952 m/s b) 16.92 m/s and 0.0952 m/s
c) 17.92 m/s and 0.0752 m/s d) 18.92 m/s and 0.0752 m/s
Answer: b

62. A plate 0.3 m long is placed at zero angle of incidence in a stream of 15 degree Celsius water moving at 1 m/s. Find out the stream wise velocity component at the mid-point of the boundary layer. For water at 15 degree Celsius p = 998.9 kg $/m^3$
$\mu = 415.85 * 10^{-2}$ kg/hr m
a) 0.736 m/s b) 0.636 m/s c) 0.536 m/s d) 0.436 m/s
Answer: a

63. Air at 25 degree Celsius flows over a flat surface with a sharp leading edge at 1.5 m/s. Find the boundary layer thickness at 0.5 from the leading edge. For air at 25 degree Celsius, kinematic viscosity = $15.53* 10n^{-6}\ m^2/s$
a) 4.1376 cm b) 3.1376 cm c) 2.1376 cm d) 1.1376 cm

64. Local skin friction coefficient is given by
a) $0.646/ (Re)^{½}$ b) $1.646/ (Re)^{½}$ c) $2.646/ (Re)^{½}$ d) $3.646/ (Re)^{1/2}$
Answer: a
.

65. A plate 0.3 m long is placed at zero angle of incidence in a stream of 15 degree Celsius water moving at 1 m/s. Find out the maximum boundary layer thickness. For water at 15 degree Celsius. For water at 15°C p = 998.9 kg $/m^3$ $\mu = 415.85 * 10^{-2}$ kg/hr m
a) 4.945 m b) 3.945 m c) 2.945 m d) 1.945 m

Answer: c

66. Shear stress at the middle of the plate is given by

a) $T_W = 0.964\ p\ U_{INFINITY}^2/2\ (Re)^{1/2}$ b) $T_W = 0.864\ p\ U_{INFINITY}^2/2\ (Re)^{1/2}$

c) $T_W = 0.764\ p\ U_{INFINITY}^2/2\ (Re)^{1/2}$ d) $T_W = 0.664\ p\ U_{INFINITY}^2/2\ (Re)^{1/2}$.

Answer: d

67. Boundary layer thickness is given by

a) $\delta = 5.64\ x/\ (Re)^{1/2}$ b) $\delta = 5.64\ x/\ (Re)^{1/2}$ c) $\delta = 6.64\ x/\ (Re)^{1/2}$ d) $\delta = 7.74\ x/\ (Re)^{1/2}$

Answer: a

68. Air at 25 degree Celsius flows over a flat surface with a sharp leading edge at 1.5 m/s. Find the value of Reynolds number. For air at 25°C, kinematic viscosity = $15.53 * 10n^{-6}\ m^2/s$

a) 38694 b) 12846 c) 48294 d) 76386

Answer: c

69. A plate 0.3 m long is placed at zero angle of incidence in a stream of 15 degree Celsius water moving at 1 m/s. Find out the maximum value of the normal component of velocity at the trailing edge of the plate. For water at 15 degree Celsius p = 998.9 kg /m^3 μ = $415.85 * 10^{-2}$ kg/hr m

a) $1.6885 * 10^{-2}$ m/s b) $1.6885 * 10^{-3}$ m/s c) $1.6885 * 10^{-4}$ m/s d) $1.6885 * 10^{-5}$ m/s

Answer: b

.

70. A fully developed laminar viscous flow through a circular tube has theratio of maximum velocity to average velocity as

(a) 3.0 (b) 2.5 (c) 2.0 d) 1.5

Ans. (c)

71.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
Ans. (d)

72.In fully developed laminar flow in a circular pipe, the head loss due to friction is directly proportional to..... (Mean velocity/square of the mean velocity).
(a) True (b) False (c) Insufficient data (d) None of the above
Ans. (a)

73.Which one of the following statements is correct? Hydrodynamic entrance length for

(a) Laminar flow is greater than that for turbulent flow
(b) Turbulent flow is greater than that for laminar flow
(c) Laminar flow is equal to that for turbulent flow
(d) A given flow can be determined only if the Prandtl number is known

Ans. (a)

74. Which one of the following statements is correct for a fully developed pipe flow?
(a) Pressure gradient balances the wall shear stress only and has a constant value.
(b) Pressure gradient is greater than the wall shear stress.
(c) The velocity profile is changing continuously.
(d) Inertia force balances the wall shear stress.

Ans. (a)

75.Which one of the following is correct? In a fully developed region of the pipe flow,
(a) The velocity profile continuously changes from linear to parabolic shape
(b) The pressure gradient remains constant in the downstream direction
(c) The pressure gradient continuously changes exceeding the wall shear stress in the downstream direction
(d) The pipe is not running full

Ans. (b)

76.In a steady flow of an oil in the fully developed laminar regime, the shear stress is
(a) Constant across the pipe
(b) Maximum at the centre an decreases parabolic ally towards the pipe wall boundary
(c) Zero at the boundary and increases linearly towards the centre.
(d) Zero at the centre and increases towards the pipe wall.

Ans. (d)

77.A 40 mm diameter 2m long straight uniform pipe carries a steady flow of water (viscosity 1.02 centipoises) at the rate of 3.0 liters per minute.What is the approximate value of the shear stress on the internal wall of the pipe?
(a)0.0166 dyne/cm2 (b)8.12 dyne/cm2 (C) 0.0812 dyne/cm2 (d)0.9932 dyne/cm2
Ans. (b)

78.The pressure drop for a relatively low Reynolds number flow in a 600mm, 30m long pipeline is 70 kPa. What is the wall shear stress?
(a)0 Pa (b) 350 Pa (c) 700 Pa (d) 1400 Pa
Ans. (b)

79.The pressure drop in a 100 mm diameter horizontal pipe is 50 kPa over a length of 10 m. The shear stress at the pipe wall is
(a) 0.25 kPa (b) 0.125 kPa (c) 0.50 kPa (d) 25.0 kPa
Ans. (b)
80.Laminar developed flow at an average velocity of 5 m/s occurs in a pipe of 10 cm radius. The velocity at 5 cm radius is:

(a) 7.5 m/s (b) 10 m/s (c) 2.5 m/s (d) 5 m/s
Ans. (a)

81.The power consumed per unit length in laminar flow for the same discharge, varies directly as Dn where D is the diameter of the pipe.What is the value of 'n'?
(a) ½ (b) -1/2 (c) -2 (d) -4
Ans. (d)

82.Velocity for flow through a pipe, measured at the centre is found to be 2 m/s. Reynolds number is around 800.What is the average velocity in the pipe?
(a) 2 m/s (b) 1.7 m/s (c) 1 m/s (d) 0.5 m/s
Ans. (c)

83.The shear stress developed in lubricating oil, of viscosity 9.81 poise, filled between two parallel plates 10 cm apart and moving with relative velocity of 2 m/s is
(a) 20 N/m2 (b) 19.62 N/m2 (c) 29.62 N/m2 (d) 40 N/m2
Ans. (b)

84.The lower critical Reynold number for a pipe flow is:
(a) Different for different fluids
(b) The Reynolds number at which the laminar flow changes to turbulent flow
(c) More than 2000
(d) The least Reynolds number ever obtained for laminar flow
Ans. (a)

85Which one of the following is the characteristic of a fully developed laminar flow?
(a) The pressure drop in the flow direction is zero
(b) The velocity profile changes uniformly in the flow direction
(c) The velocity profile does not change in the flow direction
(d) The Reynolds number for the flow is critical
Ans. (c)

86.The velocity distribution in laminar flow through a circular pipe follows the
(a) Linear law (b) Parabolic (c) Cubic power law (d) Logarithmic law
Ans. (b)

87For flow through a horizontal pipe, the pressure gradient dp/dx in the flow direction is:
(a) +ve (b) 1 (c) Zero (d) –ve
Ans. (d)

88.What is the discharge for laminar flow through a pipe of diameter 40mm having center-line velocity of 1.5 m/s?
(a) 3π/59 m3/s (b) 3π/2500 m3/s (c) 3π /5000 m3/s (d) 3π /10000m3/s
Ans. (d)

89.The MINIMUM value of friction factor ‘f’ that can occur in laminar flow through a circular pipe is:
(a) 0.064 (b) 0.032 (c) 0.016 (d) 0.008
Ans. (b)

90. The drag coefficient for laminar flow varies with Reynolds number (Re) as
(a) Re1/2 (b) Re (c) Re-1 (d) Re-1/2
Ans. (c)

91.When we consider the momentum exchange between two adjacent layers in a turbulent flow, can it be postulated that if at an instant there is an increase in u' in the *x*-direction it will be followed by a change in v' in the y direction?
(a) Yes, in such a manner that $u'v' = 0$
(b) Yes, in such a manner that $u'v'$ = non-zero and positive.
(c) Yes, in such a manner that $u'v'$ = non-zero and negative.
(d) No, as u' and v' are not dependent on each other.
Ans. (c)

92.In fully-developed turbulent pipe flow, assuming 1/7th power law, the ratio of time mean velocity at the centre of the pipe to that average velocity of the flow is
(a) 2.0 (b) 1.5 (c) 1.22 (d) 0.817
Ans. (d)

93.Reynolds stress may be defined as the
(a) Stresses (normal and tangential) due to viscosity of the fluid.
(b) Additional normal stresses due to fluctuating velocity components in a turbulent flow.
(c) Additional shear stresses due to fluctuating velocity components in a turbulent flow.
(d) Additional normal and shear stresses due to fluctuating velocity components in the flow field.
Ans. (c)

94.In turbulent flow over an impervious solid wall
(a) Viscous stress is zero at the wall
(b) Viscous stress is of the same order of magnitude as the Reynolds stress
(c) The Reynolds stress is zero at the wall
(d) Viscous stress is much smaller than Reynolds stress
Ans. (d)

95.Shear stress in a turbulent flow is due to:
(a) The viscous property of the fluid.
(b) The fluid flow property
(c) Fluctuation of velocity in the direction of flow
(d) Fluctuation of velocity in the direction of flow as well as transverse to it
Ans. (d)

96.The pressure drop in a 100 mm diameter horizontal pipe is 50 kPa over a length of 10m. The shear stress at the pipe wall is
(a) 0.25 kPa (b) 0.125 kPa (c) 0.50 kPa (d) 25.0 kPa
Ans. (b)

97.Flow takes place and Reynolds Number of 1500 in two different pipes with relative roughness of 0.001 and 0.002. The friction factor
(a) Will be higher in the case of pipe with relative roughness of 0.001.
(b) Will be higher in the case of pipe having relative roughness of 0.002.
(c) Will be the same in both the pipes.
(d) In the two pipes cannot be compared on the basis of data given
Ans. (c)

98.In a fully turbulent flow through a rough pipe, the friction factor 'f' is (Re is the Reynolds number and / $S\ \xi\ D$ is relative roughness)
(a) A function of Re (b) A function of Re and / $S\ \xi\ D$
(c) A function of / $S\ \xi\ D$ (d) Independent of Re and / $S\ \xi\ D$
Ans. (b)

99.Consider the following statements:
- The friction factor in laminar flow through pipes is independent of roughness.
- The friction factor for laminar flow through pipes is directly proportional to Reynolds number.
- In fully turbulent flow, through pipes, friction factor is independent of Reynolds number.

Which of the statements given above are correct?
(a) 1, 2 and 3 (b) 1 and 3 only (c) 2 and 3 only (d) 1 and 2 only
Ans. (b)

100.While water passes through a given pipe at mean velocity V the flow is found to change from laminar to turbulent. If another fluid of specific gravity 0.8 and coefficient of viscosity 20% of that of water, is passed through the same pipe, the transition of flow from laminar to turbulent is expected if the flow velocity is
(a) 2V (b) V (c) V/2 (d) V/4
Ans. (d)