

BASIC LEVEL FM TEST 07 AUG 2018**TIME: 75 MINUTES****CORRECT ANSWER: 1 MARKS****INCORRECT ANSWER: - 0.25 MARKS****QUALIFYING MARKS: 40 MARKS**

1. When vertical cylindrical vessel containing water is rotated about its axis, then the free surface of water becomes:

- (a) A cycloid of revolution
- (b) An ellipsoid of revolution
- (c) A hyperboloid of revolution
- (d) A paraboloid of revolution

2. For warships, metacentric height of a ship should vary between

- (a) 0-1 m
- (b) 1-2 m
- (c) 5-10 m
- (d) More than 10 m

3. A floating body has centre of buoyancy at B centre of gravity at G and metacentre at M. Then for stable equilibrium of the body

- (a) $MG = 0$
- (b) M is below G
- (c) $BG = 0$
- (d) M is above G

4. If a piece of metal having a specific gravity of 13.6 is placed in mercury of specific gravity 13.6, then

- (a) The metal piece will sink to the bottom
- (b) The metal piece will simply float over the mercury with no immersion
- (c) The metal piece will be immersed in mercury by half
- (d) The whole of the metal piece will be immersed with its top surface just at mercury level

5. The metacentric height GM is expressed as

- (a) $GM = BG - \frac{I}{V}$
- (b) $GM = \frac{V}{I} - BG$
- (c) $GM = \frac{I}{V} - BG$

$$(d) GM = BG - \frac{V}{I}$$

Where,

I = moment of inertia of the plan of floating body at the water surface

V = volume of the body submerged in water

BG = distance between the centre of gravity G and the centre of buoyancy B.

6. The height of water column corresponding to a pressure equivalent of 75 cm of mercury column is

- (a) 1000 cm
- (b) 1020 cm
- (c) 1040 cm
- (d) 1060 cm

7. A square plate 3 m × 3 m is just held submerged below water in a vertical position. The total pressure on one face is about

- (a) 33 kN
- (b) 66 kN
- (c) 132 kN
- (d) 265 kN

8. The depth of centre of pressure in a rectangular lamina immersed vertically in water upto height h is given by:

- (a) $h/4$
- (b) $2h/3$
- (c) $3h/4$
- (d) $h/2$

9. Capillary rise and depression

- (a) depend solely upon the surface tension of the liquid
- (b) are influenced by viscosity of the liquid
- (c) depend upon the pressure difference between the liquid and the environment
- (d) depend upon surface tension of the liquid as well as the material of the tube

10. Water rises to a height of 15 mm in a capillary tube of 10 mm radius. The corresponding rise in a capillary of 5 mm radius would be

- (a) 3.87 mm
- (b) 7.5 mm
- (c) 15 mm
- (d) 30 mm

11. What is the pressure difference between inside and outside of a droplet of water?
- $2 \sigma / d$
 - $4 \sigma / d$
 - $8 \sigma / d$
 - $12 \sigma / d$
12. The general relation between shear stress τ and velocity gradient $(du/dy)^n + B$ Which of the followings is then a false statement?
- For ideal fluids: $A = B = 0$
 - For Newtonian fluids : $n = 1$ and $B = 0$
 - For dilatants fluids: $n < 1$ and $B = 0$
 - For ideal plastic or Bingham fluid: $n = 1$ and $B = \tau_0$
13. Paper pulp can be regarded as
- Newtonian fluid
 - Dilatants fluid
 - Pseudoplastic fluid
 - Bingham plastic
14. Typical example of a non-Newtonian fluid of pseudoplastic variety is
- Air
 - Blood
 - Water
 - Printing ink
15. The coefficient of viscosity is a property of
- The fluid
 - The boundary condition
 - The body over which flow occurs
 - The flow velocity
16. The multiplying factor for converting one stoke into m^2 / s is
- 10^2
 - 10^4
 - 10^{-2}
 - 10^{-4}
17. At a certain point in castor oil, the shear stress is 0.2158 N/m^2 and the velocity gradient 0.22 per second. The dynamic viscosity of castor oil in poises is numerically equal to
- 0.1 g
 - 1 g
 - 10 g
 - 100 g
18. The density of a fluid is sensitive to changes in pressure. The fluid will be known as
- Newtonian fluid
 - Perfect fluid
 - Real fluid
 - Compressible fluid
19. The bulk modulus of water with respect to air is about
- 500
 - 1000
 - 10,000
 - 20,000 times
20. A circular cylinder partly filled with a liquid is rotated about its axis at ω rad/s without spilling. At the walls, the rise of liquid surface above the original level will be
- $\frac{\omega^2 r^2}{g}$
 - $\frac{\omega^2 r^2}{2g}$
 - $\frac{\omega^2 r^2}{4g}$
 - $\frac{\omega^2 r^2}{8g}$
21. At the stagnation point in a flow field
- Pressure is zero
 - Total energy is zero
 - Velocity head gets dissipated into heat
 - Velocity head gets converted into pressure head
22. Magnus effect is defined as
- Generation of lift per unit drag force
 - Circulation induced in an aircraft wing
 - Separation of boundary layer near the trailing edge of a slender body
 - Generation of lift on a rotating cylinder in a uniform flow
23. The stream function in a flow field is given by $\psi = 2xy$. In the same flow field, what is the velocity at point (2, 1)?
- 4 unit
 - 5.4 unit
 - 1.73 unit
 - 4.47 unit

24. One dimensional flow means

- (a) Uniform flow
- (b) Steady flow
- (c) Straight line flow
- (d) Flow which neglects changes in transverse direction

(a) $\frac{u}{dx} = \frac{dy}{v}$

(b) $\frac{du}{dx} = \frac{dv}{dy} = 0$

(c) $\frac{dy}{u} = \frac{dx}{v}$

(d) $\frac{dx}{u} = \frac{dy}{v}$

25. The flow of liquid through a tapering pipe at constant rate is

- (a) Steady uniform
- (b) Steady non-uniform
- (c) Unsteady uniform
- (d) Unsteady non-uniform

31. For maximum power transmission through a pipe line, the frictional head loss equals

- (a) H/4
- (b) H/3
- (c) H/2
- (d) 3H/5

26. For a steady incompressible flow, the u-component of velocity is given as $u = A e^x$. The corresponding v-component of velocity is

- (a) $A e^y$
- (b) $A e^x y$
- (c) $-A e^x y$
- (d) $-A e^x$

32. The loss of head due to sudden contraction is given by $K_{con} V^2/2g$. The contraction loss coefficient K_{con} in terms of coefficient of contraction C_c is

- (a) $1 - C_c^2$
- (b) $(1/C_c - 1)^2$
- (c) $(1 - C_c)^2$
- (d) $(1/C_c^2 - 1)$

27. A steady incompressible flow is given by

$$u = 2x^2 + y^2 \text{ and } v = -4xy$$

What is the convective acceleration along x-direction at point (1,2)

- (a) $a_x = 6$ unit
- (b) $a_x = 24$ unit
- (c) $a_x = -8$ unit
- (d) $a_x = -24$ unit

33. Which of the following bends will cause maximum head loss?

- (a) 30° bend
- (b) 60° bend
- (c) 90° bend
- (d) U-bend

28. A stream-line is a line

- (a) which is along the path of the particle
- (b) which is always parallel to the direction of flow
- (c) along which there is no flow
- (d) on which tangent drawn at any point gives the direction of velocity at that point

34. When water is lifted by a pipeline from a reservoir to a height greater than the level in the supply reservoir, the pipe is called

- (a) Syphon
- (b) Pressure pipe line
- (c) Tunnel
- (d) Penstock

29. There is no geometrical distinction between the stream-line, path-line and streak-line in case of

- (a) steady flow
- (b) uniform flow
- (c) laminar flow
- (d) irrotational flow

35. If H is the total head at inlet and H_f is the head lost due to friction, efficiency of power transmission through a straight pipe is given by

(a) $\frac{H - H_f}{H}$ (b) $\frac{H}{H + H_f}$

30. For a two-dimensional flow field, the equation of a stream-line is given as

$$(c) \frac{H - H_f}{H + H_f} \quad (d) \frac{H}{H - H_f}$$

36. The shear stress between two fixed parallel plates with a laminar flow between them

- (a) Varies directly as distance from the mid-plane.
- (b) Varies inversely as distance from the mid-plane.
- (c) Varies parabolically across the gap
- (d) Remains constant across the gap

37. Venturimeter is used to measure flow of fluids in pipes when pipe is

- (a) horizontal
- (b) vertical, flow downwards
- (c) in any position.
- (d) inclined position

38. Capillary tube viscometers used for measurement of viscosity are based on

- (a) stoke's law
- (b) chezy equation
- (c) Hagen-Poiseuille equation
- (d) Darcy – Weisbach equation

39. The hydraulic mean diameter used in place of diameter for non-circular ducts is equal to

$$(a) \frac{A}{P} \quad (b) \frac{4A}{P}$$

$$(c) \frac{2A}{P} \quad (d) \frac{4P}{A}$$

Where A is area of flow and P is the wetted perimeter.

40. Boundary layer separation is caused by:

- (a) Adverse pressure gradient
- (b) Laminar flow changing to turbulent flow
- (c) Reduction in pressure to vapour pressure
- (d) Decrease in boundary layer thickness to a negligible value

41. What is the commonly used boundary layer control method to prevent separation?

- (a) Use of smooth boundaries
- (b) Using large divergence angle in the boundary

(c) Suction of accelerating fluid within the boundary

(d) Suction of retarded fluid within the boundary

42. For laminar flow through a pipe, the discharge varies

- a) Linearly as the diameter
- b) Inversely as the square of diameter
- c) As the inverse of viscosity
- d) Inversely as the pressure gradient

43. The velocity of sound is largest in

- (a) Air
- (b) Kerosene
- (c) Water
- (d) Steel

44. Dimensional analysis is useful in

- (a) Checking the correctness of a physical equation
- (b) Determining the number of variables involved in a particular phenomenon
- (c) Determining the dimensionless groups from the given variables
- (d) The exact formulation of a physical phenomenon

45. Consider the Chezy equation for flow velocity through a channel: $V = C\sqrt{mi}$ where V is the flow velocity in m/s, m is the hydraulic mean depth in m and i is the longitudinal slope of the channel. In [M, L, T] notation system, the dimensions of the Chezy constant C are:

- (a) $ML^{-1}T$
- (b) $M^0L^0T^0$
- (c) $L^{1/2}T^{-1}$
- (d) L^2T^{-1}

46. Kinematic similarity between model and prototype is

- (a) The similarity of streamline pattern
- (b) The similarity of discharge
- (c) The similarity of force influencing the flow
- (d) The use of same model scale throughout

47. It is observed in a flow problem that pressure, inertia and gravity forces are important. Then, similarity 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 number be equal

48. In similitude with gravity force, where equality of Froude's number exists, the velocity ratio becomes

- (a) 1.0
- (b) $(L_r)^{1/2}$
- (c) $\frac{1}{L_r}$
- (d) $(L_r)^{3/2}$

49. It is proposed to model a submarine at 10 m/s by testing a 10 : 1 scale model. The model need to be moved with a velocity of

- (a) 1 m/s
- (b) 10 m/s
- (c) 50 m/s
- (d) 100 m/s

50. The model of a propeller, 3 m in diameter and 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) 2000 N
- (c) 500 N
- (d) 200 N

51. If angle of contact of a drop of liquid is acute, then

- a) Cohesion is equal to adhesion
- b) Cohesion is more than adhesion
- c) adhesion is more than cohesion
- d) Both adhesion and cohesion have no connection with angle of contact

52. The centre of pressure

- a) The centroid of the pressure prism
- b) A point on the line of action of the resultant force
- c) At the centroid of the submerged area
- d) Always above the centroid of the area

53. Stability of a freely falling object is assured if its centre of

- a) Buoyancy lies below its centre of gravity
- b) Gravity coincides with its centre of buoyancy
- c) Gravity lies below its metacentre
- d) Buoyancy lies below its metacentre

54. What is buoyant force?

- a) Lateral force acting on a submerged body
- b) Resultant force acting on a submerged body
- c) Resultant force due to water on a body
- d) Resultant hydrostatic force on a body due to fluid surrounding it

55. A flownet is a graphical representation of streamlines and equipotential lines such that these lines

- a) Intersect each other at various different angles forming irregular shaped nets
- b) Intersect each other orthogonally forming curvilinear squares
- c) Indicate the direction but not magnitude of vector
- d) Indicate the direction and magnitude of vector

56. Why are surge tanks used in pipe line?

- a) To reduce frictional loss in pipe
- b) To ensure uniform flow in pipe
- c) To relieve the pressure due to water hammer
- d) To reduce cavitation

57. The piezometric head is the summation of

- a) Velocity head and pressure head
- b) Pressure head and elevation head
- c) Elevation head and velocity head
- d) Velocity head, pressure head and elevation head

58. How are the velocity coefficient C_v , the discharge coefficient C_d , and the contraction coefficient C_c of an orifice related?

- a) $C_v = C_c C_d$
- b) $C_c = C_v C_d$
- c) $C_d = C_c C_v$
- d) $C_c C_v C_d = 1$

59. Euler number is defined as the ratio of inertia force to

- a) Viscous force
- b) Elastic force
- c) Pressure force
- d) Gravity force

60. If 'n' variables in a physical phenomenon contained 'm' fundamental dimensions, then the variable can be arranged into

- a) n dimensionless terms
- b) m dimensionless term
- c) (n – m) dimensionless terms
- d) (n + m) dimensionless terms

