

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

Test Booklet Series

Serial No.

169402

B

## SCREENING TEST – 2009

SUBJECT : A. E. (CIVIL)

Time Allowed : Two Hours

Maximum Marks : 120

### INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET **DOES NOT** HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS, ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. ENCODE CLEARLY THE TEST BOOKLET SERIES **A, B, C** OR **D** AS THE CASE MAY BE IN THE APPROPRIATE PLACE IN THE RESPONSE SHEET.
3. You have to enter your Roll Number on this Test Booklet in the Box provided alongside. **DO NOT** write *anything* else on the Test Booklet.  

Your Roll No. .....
------------------------
4. This Booklet contains **120** items (questions). Each item comprises four response (answers). You will select one response which you want to mark on the Response Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose **ONLY ONE** response for each item.
5. In case you find any discrepancy, in this test booklet in any question(s) or the Responses, a written representation explaining the details of such alleged discrepancy, be submitted within three days, indicating the Question No(s) and the Test Booklet Series, in which the discrepancy is alleged. Representation not received within time shall not be entertained at all.
6. You have to mark all your responses **ONLY** on the separate Response Sheet provided. See directions in the Response Sheet.
7. All items carry equal marks. Attempt **ALL** items. Your total marks will depend only on the number of correct responses marked by you in the Response Sheet.
8. Before you proceed to mark in the Response Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Response Sheet as per instructions sent to you with your Admit Card and Instructions.
9. While writing Centre, Subject, and Roll No. on the top of the Response Sheet in appropriate boxes use "**ONLY BALL POINT PEN**".
10. After you have completed filling in all your response on the Response Sheet and the examination has concluded, you should hand over to the Invigilator only the Response Sheet. You are permitted to take away with you the Test Booklet.

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

SEAL

(For Rough Work)

## Screening Test – 2009

Subject : A.E. (CIVIL)

Time Allowed : Two Hours ]

[ Max. Marks : 120

1. The value of compression index for a remoulded soil sample whose liquid limit is 50% is :
  - (a) 0.028
  - (b) 0.28
  - (c) 0.36
  - (d) 0.036
2. A normal consolidated clay settled 10 mm when effective stress was increased from 100 kN/m<sup>2</sup> to 200 kN/m<sup>2</sup>. If the effective stress is further increased from 200 kN/m<sup>2</sup> to 400 kN/m<sup>2</sup> then settlement of the same clay is :
  - (a) 10 mm
  - (b) 20 mm
  - (c) 40 mm
  - (d) none of the above
3. The shear strength of soil is :
  - (a) directly proportional to the angle of internal friction of the soil
  - (b) inversely proportional to the angle of internal friction of the soil
  - (c) decreases with the increase in normal stress
  - (d) decreases with the decrease in normal stress
4. Unconfined compressive strength test is :
  - (a) undrained test
  - (b) drained test
  - (c) consolidated undrained test
  - (d) consolidated drained test
5. Rankine's theory of earth pressure assumes that the back of the wall is :
  - (a) plane and smooth
  - (b) plane and rough
  - (c) vertical and smooth
  - (d) vertical and rough
6. The coefficient of active earth pressure for loose sand having  $\phi = 30^\circ$  is :
  - (a) 1/3
  - (b) 3
  - (c) 1
  - (d) 1/2
7. Which of the following earth pressure theories is directly applicable to bulk-heads :
  - (a) Rankine's theory
  - (b) Coulomb's theory
  - (c) both (a) and (b)
  - (d) Skempton's theory

8. The critical height of an unsupported vertical cut in a cohesive soil is given by :
- $\frac{4c}{\gamma} \tan(45 + \phi/2)$
  - $\frac{2c}{\gamma} \tan(45 + \phi/2)$
  - $\frac{4c}{\gamma} \tan(45 - \phi/2)$
  - $\frac{2c}{\gamma} \tan(45 - \phi/2)$
9. The maximum differential settlement in an isolated footing in clayey soil should be limited to :
- 25 mm
  - 40 mm
  - 65 mm
  - 100 mm
10. A retaining wall 6 m high supports a backfill with a surcharge angle of  $10^\circ$ . The back of the wall is inclined to the vertical at a positive batter angle of  $5^\circ$ . If the angle of wall friction is  $7^\circ$ , the resultant active earth pressure will act at distance 2 m above base and inclined to the horizontal at an angle of :
- $7^\circ$
  - $10^\circ$
  - $12^\circ$
  - $17^\circ$
11. If the voids of a soil mass are full of air only, the soil is termed as :
- air entrained soil
  - partially saturated soil
  - dry soil
  - dehydrated soil
12. If the degree of saturation of soil is 60%, then the air content of the soil is :
- 40%
  - 60%
  - 80%
  - 100%
13. Stoke's law is valid only if the particle size is :
- less than 0.0002 mm
  - greater than 0.2 mm
  - between 0.2 mm and 0.0002 mm
  - all of the above
14. The hydraulic head that would produce a quick sand condition in a stratum of thickness 1.5 m, specific gravity 2.67, void ratio 0.67 is equal to :
- 1.0 m
  - 1.5 m
  - 2.0 m
  - 3.0 m
15. For a clay slope of height 10 m, stability number 0.005, bulk density  $20 \text{ kN/m}^3$  and cohesion  $25 \text{ kN/m}^2$ , the critical height of the slope will be :
- 10.0 m
  - 12.5 m
  - 25.0 m
  - none of the above

16. A rectangular footing of size (L × B) can be treated as a strip footing when L/B ratio is greater than :
- 2
  - 4
  - 8
  - 16
17. The Engineering News formula for computing the allowable load carrying capacity ( $Q_a$ ) of a pile driven through the fall of hammer of weight (W) and fall height (H cms) steam hammer giving (S cms) penetration with the last blow is given by :
- $\frac{WH}{(S+0.25)}$
  - $\frac{WH}{6(S+0.25)}$
  - $\frac{WH}{(S+2.5)}$
  - $\frac{WH}{6(S+2.5)}$
18. Skin frictional resistance along a pile is provided by :
- relative settlement of the pile
  - relative settlement of the soil
  - both (a) and (b)
  - none of the above
19. The ultimate load carrying capacity of an end bearing pile is 200kN. The total load carrying capacity of a group of 9 such piles with unknown group efficiency shall be :
- 1800 kN
  - less than 1800 kN
  - more than 1800 kN
  - none of the above
20. The minimum centre to centre distance between the piles of a pile group in clayey soil should be equal to :
- dia. of the pile
  - 2 × Dia. of the pile
  - $\pi$  × Dia. of the pile
  - none of the above
21. Uniformity coefficient of soil is :
- always less than 1
  - always equal to 1
  - equal to or less than 1
  - equal to or greater than 1
22. The liquid limit of a soil mass is 20% and its plastic limit is 25% then the plasticity index of this soil is :
- 5
  - 5
  - 0
  - none of the above
23. A soil is considered to be active if the activity number is :
- greater than 1.0
  - between 0.75 and 1.0
  - less than 0.75
  - less than 1.0
24. Method more suitable for determining the permeability of the clayey soils is :
- constant head permeameter
  - falling head permeameter
  - horizontal permeability test
  - none of the above

25. The depth of capillary fringe in a soil mass having void ratio of 0.70 and effective size of soil grains  $D_{10} = 0.1$  mm will be :
- 34.5 cms
  - 24.6 cms
  - 38.1 cms
  - none of the above
26. Coarse grained soil are best compacted by :
- drum rollers
  - rubber tyred rollers
  - sheep foot rollers
  - vibratory rollers
27. The soil saturation in a compacted soil mass at OMC will be :
- 100%
  - 90-95%
  - 0%
  - none of the above
28. Newmark's chart in foundation engineering is used to determine :
- stresses in soil due to surface loading
  - seepage loss
  - earth pressure
  - permeability of soils
29. When normal stress is  $100 \text{ kN/m}^2$ , the magnitude of shear stress on a principal plane is :
- infinity
  - $100 \text{ kN/m}^2$
  - $200 \text{ kN/m}^2$
  - zero
30. In a triaxial test, a sample of (c- $\phi$ ) soil fails making an angle of  $\alpha^\circ$  with the horizontal, the value of ( $\phi$ ) is given by :
- $2(\alpha^\circ - 45^\circ)$
  - $(\alpha^\circ + 45^\circ)$
  - $2(45^\circ - \alpha^\circ)$
  - $2\alpha^\circ$
31. A uniformly distributed load  $w/m$  shorter than the span crosses a girder. The bending moment at a section in the girder will be maximum when :
- head of the load is at the section
  - tail of the load is at the section
  - section divides the load in the same ratio as it divides the span
  - section divides the load in equal lengths
32. The carry over factor in moment distribution method for a prismatic member whose far end is hinged is :
- 0
  - $\frac{1}{2}$
  - $\frac{3}{4}$
  - 1

33. If there are (m) unknown member forces, (r) unknown reaction components and (j) number of joints, the degree of kinematic indeterminacy of a pin-jointed plane frame is given by :

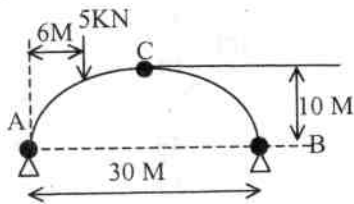
- (a)  $2j - r$
- (b)  $j - 2r$
- (c)  $3j - r$
- (d)  $2j + r$

34. The fixed support of a real beam becomes in the conjugate beam :

- (a) roller support
- (b) hinged support
- (c) fixed support
- (d) free support

35. A three hinged arch carries a load as shown. The horizontal thrust is :

- (a) 1.0 kN
- (b) 1.5 kN
- (c) 4.0 kN
- (d) 5.0 kN



36. A simply supported beam carries a point load (w) at the centre. The flexural stiffness of the beam is if the span is (l) :

- (a)  $\frac{24EI}{l^3}$
- (b)  $\frac{48EI}{l^3}$
- (c)  $\frac{6EI}{l^2}$
- (d)  $\frac{4EI}{l}$

37. A tensile load (P) acts on an axial member of length (l) and cross-sectional area (A) such that it undergoes extensions. If (E) is the elastic modulus the axial stiffness is :

- (a)  $\frac{PE}{l}$
- (b)  $\frac{PA}{l}$
- (c)  $\frac{EA}{l}$
- (d)  $\frac{Pl}{A}$

38. The unit of rotational inertia of a body in C. G. S. system is :

- (a)  $\text{cms}^4$
- (b)  $\text{kg} - \text{cms}^2$
- (c)  $\text{gms} - \text{cms}^2$
- (d)  $\text{gms} - \text{cms}^3$

39. A cube rests on a rough horizontal surface and the coefficient of friction between the cube and the surface is  $\mu$ . If the cube is gradually tilted from horizontal by tilting the plane on which it rests then the equilibrium is disturbed by sliding first if :

(a)  $\mu < \frac{1}{2}$

(b)  $\mu > \frac{1}{2}$

(c)  $\mu < 1$

(d)  $\mu > 1$

40. A ball of mass ( $m_1$ ) impinges directly on a stationary ball of mass ( $m_2$ ). If the coefficient of restitution between them is ( $e$ ) then the fraction of the total kinetic energy dissipated by the impact is :

(a)  $\frac{m_1(1-e^2)}{m_1 + m_2}$

(b)  $\frac{m_2(1-e^2)}{m_1 + m_2}$

(c)  $\frac{m_1(1-e)^2}{m_1 + m_2}$

(d)  $\frac{m_2(1-e)^2}{m_1 + m_2}$

41. The slope at the support in a simply supported beam of span ( $l$ ) carrying a concentrated load  $w$  at the mid span is :

(a)  $\frac{wl^2}{4EI}$

(b)  $\frac{wl^2}{8EI}$

(c)  $\frac{wl^2}{12EI}$

(d)  $\frac{wl^2}{16EI}$

42. A simply supported beam of span 6 m carries a point load at the centre of the beam such that the maximum bending moment under load is 12 kN-M. If ( $EI$ ) is the flexural rigidity of the beam, the deflection at the centre is :

(a)  $\frac{9}{EI}$

(b)  $\frac{18}{EI}$

(c)  $\frac{36}{EI}$

(d)  $\frac{45}{EI}$



43. The shear stress in circular shaft varies :

- (a) uniformly
- (b) parabolically
- (c) hyper-parabolically
- (d) linearly

44. A solid circular shaft of diameter (d) transmits a torque (T) the maximum shear stress is :

- (a)  $\frac{16T}{\pi d^3}$
- (b)  $\frac{32T}{\pi d^3}$
- (c)  $\frac{64T}{\pi d^3}$
- (d)  $\frac{128T}{\pi d^3}$

45. When a close coiled helical spring of mean diameter (D) is subjected to an axial load (w), the deflection of the spring is ((n) is number of coils and (d) is diameter of wire) :

- (a)  $\frac{4wD^3n}{Gd^4}$
- (b)  $\frac{8wD^3n}{Gd^4}$
- (c)  $\frac{16wD^3n}{Gd^4}$
- (d)  $\frac{32wD^3n}{Gd^4}$

46. The shearing strain energy stored in material subjected to constant shearing stress is :

- (a)  $\frac{\tau^2}{G^2} \times \text{vol.}$
- (b)  $\frac{\tau^2}{2G} \times \text{vol.}$
- (c)  $\frac{\tau^2}{4G^2} \times \text{vol.}$
- (d)  $\frac{\tau^2}{4G} \times \text{vol.}$

47. In a thin cylindrical vessel of thickness (t) with closed ends is subjected to internal fluid pressure (p). The major principal stress is :

- (a)  $\frac{pd}{2t}$
- (b)  $\frac{pd}{4t}$
- (c)  $\frac{pd}{8t}$
- (d)  $\frac{pd}{16t}$

48. In a thin cylindrical shell the ratio of hoop stress to longitudinal stress is :

- (a)  $\frac{1}{2}$
- (b) 2
- (c)  $\frac{1}{4}$
- (d) 4

49. The principal plane is the :
- plane on which shear stress is zero
  - plane on which normal stress is zero
  - plane on which shear stress is maximum
  - plane on which both normal and shear stress are zero
50. The major and minor principal stress at a point are 120 MPa and 70 MPa. On a plane passing through a point, the normal stress is 115 MPa. The shear stress on the plane is :
- 5 MPa
  - 10 MPa
  - 15 MPa
  - 20 MPa
51. A system of coplanar forces is in equilibrium when :
- force polygon closes
  - funicular polygon closes
  - both force and funicular polygon closes
  - all the forces are concurrent
52. The rate of change of angular momentum is equal to :
- force
  - torque
  - linear momentum
  - impulse
53. At the instantaneous centre, the velocity of moving lamina at any instant is :
- zero
  - maximum
  - minimum
  - varying
54. Minimum potential energy of a system will be in the position of :
- stable equilibrium
  - unstable equilibrium
  - neutral equilibrium
  - all of the above
55. Which of the following is a scalar quantity ?
- energy
  - momentum
  - torque
  - impulse
56. The ratio of shear stress to shear strain is called :
- bulk modulus of elasticity
  - modulus of rigidity
  - modulus of elasticity
  - Poisson's ratio

57. The relation between elastic constant  $E$ ,  $K$  and  $G$  is :

(a)  $E = 2G(1 + K)$

(b)  $E = \frac{9KG}{3K + G}$

(c)  $E = G(1 + 3K)$

(d)  $E = \frac{3K - G}{9KG}$

58. A steel bar 1 meter long and  $1.5 \text{ cm}^2$  cross-sectional area is subjected to a pull of 1500 N. If  $E = 2 \times 10^5 \text{ N/mm}^2$  the elongation in the bar is :

(a) 1.0 mm

(b) 0.5 mm

(c) 1.5 mm

(d) 2.0 mm

59. The shear force at the free end of a cantilever beam of span ( $l$ ) carrying a uniformly distributed load of  $w/m$  is :

(a)  $\frac{wl}{2}$

(b)  $wl$

(c)  $\frac{wl}{4}$

(d) 0

60. The bending moment in a beam is maximum at a section where shear force is :

(a) maximum

(b) minimum

(c) unaltered

(d) changes sign

61. The constant vertical distance between two adjacent contours is called :

(a) contour gradient

(b) contour interval

(c) horizontal equivalent

(d) vertical equivalent

62. If the level tube is out of adjustment by an angle ( $e$ ) and when the telescope is rotated through  $180^\circ$  it becomes :

(a)  $4e$

(b)  $3e$

(c)  $2e$

(d)  $-e$

63. The upper plate is fixed to :

(a) outer spindle

(b) inner spindle

(c) levelling head

(d) level tube

64. The final setting of the plates when taking a foresight is achieved by using :
- upper clamp screw
  - upper tangent screw
  - lower clamp screw
  - lower tangent screw
65. Substense bar system is generally used for measurement of horizontal distances in :
- undulating areas
  - mountainous areas
  - flat area
  - triangulation
66. In tacheometrical observations, vertical staff holding is generally preferred to normal staffing due to :
- ease in reduction of observation
  - facility of holding
  - minimum effect of careless holding on the result
  - none of the above
67. Under ordinary conditions the precision of a theodolite is affected by :
- systematic angular errors
  - accidental linear errors
  - systematic linear errors
  - accidental angular errors

68. The length of long chord and tangent of a circular curve of radius (R) will be equal if the angle of deflection is :
- $30^\circ$
  - $60^\circ$
  - $90^\circ$
  - $120^\circ$
69. If an error makes a measurement too great it is a :
- positive error
  - compensating error
  - negative error
  - none of the above
70. Accidental errors are proportional to :
- $n$
  - $\sqrt{n}$
  - $\frac{1}{n}$
  - $\frac{1}{\sqrt{n}}$
- where ( $n$ ) is the number of observation.
71. A subsidiary line is the same as :
- range tie
  - tie line
  - survey line
  - base line

72. Agonic lines pass through points of :

- (a) equal declination
- (b) zero declination
- (c) equal dip
- (d) maximum declination

73. The sum of intensive angles of a closed traverse of (N) sites is :

- (a)  $(N-1) \times 180^\circ$
- (b)  $(N-2) \times 180^\circ$
- (c)  $(2N-1) \times 180^\circ$
- (d)  $(N-4) \times 180^\circ$

74. In a closed traverse if  $\Sigma L =$  negative and  $\Sigma D =$  positive, the whole circle bearing of the error of closure will be between :

- (a)  $0^\circ$  to  $90^\circ$
- (b)  $90^\circ$  to  $180^\circ$
- (c)  $180^\circ$  to  $270^\circ$
- (d)  $270^\circ$  to  $360^\circ$

75. The Bowditch rule is based on the assumption that the probable error is proportional to, when ( $l$ ) is the length of the line :

- (a)  $l$
- (b)  $\sqrt{l}$
- (c)  $l^2$
- (d)  $\frac{1}{l}$

76. The omitted measurements can be computed if they are not more than :

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

77. Three point problem can be solved by :

- (a) Lehmann's method
- (b) Bessel's method
- (c) Mechanical method
- (d) All of the above

78. A bubble tube with division of 2 mm and a radius of 10 m has the sensitivity of about :

- (a) 40 sec.
- (b) 80 sec.
- (c) 20 sec.
- (d) 2 sec.

79. With the rise in temperature, the sensitivity of the bubble tube :

- (a) decreases
- (b) increases
- (c) first increases and then decreases
- (d) remains unaffected

80. The following type of levelling cannot be done with a dumpy level :

- (a) differential levelling
- (b) reciprocal levelling
- (c) trigonometrical levelling
- (d) profile levelling

81. In alluvial channels, the bed particles are initiated to motion when :

- (a) particles are of finer size
- (b) the bed shear stress is just enough to overcome the frictional resistance
- (c) the water depth is small
- (d) the particles are loosely packed

82. In an open channel minimum specific energy at a given flow and maximum flow at a given specific energy occurs when Froude's number is :

- (a) unity
- (b) less than unity
- (c) equal to zero
- (d) none of the above

83. If a rectangular channel is contracted, the water surface is elevated in a contracted portion if the approaching flow is :

- (a) sub-critical
- (b) critical
- (c) super-critical
- (d) none of the above

84. In a venturi flume, the standing wave will :

- (a) occur at any section
- (b) occur at the throat
- (c) occur at the exit of the venturi flume
- (d) not occur at any section in the venturi flume

85. The maximum velocity occurs in a channel of circular cross-section at a depth of :

- (a) 0.30 times the channel diameter
- (b) 0.5 times the channel diameter
- (c) 0.81 times the channel diameter
- (d) 0.95 times the channel diameter

86. Because of hydraulic jump, a much greater loss of energy occurs in :

- (a) standing wave flume
- (b) venturi flume
- (c) venturi meter
- (d) orifice meter

87. The coefficient of linear expansion for invar as compared to that of steel is about :

- (a)  $\frac{1}{500}$
- (b)  $\frac{1}{100}$
- (c)  $\frac{1}{30}$
- (d)  $\frac{1}{200}$

88. If ( $h$ ) is the difference in height between the end points of a chain of length ( $L$ ) the slope correction is approximately equal to :

(a)  $-\frac{h^2}{2L}$

(b)  $-\frac{h}{2L}$

(c)  $-\frac{2h^2}{L}$

(d)  $\frac{2h^2}{L}$

89. If a 20 m chain diverges a perpendicular distance of 2 m from its correct alignment, the error in length is :

(a) + 0.10 m

(b) - 0.10 m

(c) + 0.20 m

(d) - 0.20 m

90. An invar tape is made of an alloy of :

(a) brass and steel

(b) nickel and steel

(c) copper and steel

(d) copper and brass

91. Laminar flow through a circular tube was studied experimentally by :

(a) Prandtl

(b) Hagen and Poiseulle

(c) Mannings

(d) Newton

92. The discharge in  $\text{m}^3/\text{s}$  for laminar flow through a pipe of diameter 0.04 m having a centre line velocity of 1.5 m/s is :

(a)  $\frac{3\pi}{59}$

(b)  $\frac{3\pi}{2,500}$

(c)  $\frac{3\pi}{5,000}$

(d)  $\frac{3\pi}{10,000}$

93. The essential feature of turbulent flow is :

(a) large discharge

(b) high velocity

(c) velocity and pressure at a point exhibit irregular fluctuations of high frequency

(d) velocity at a point remains constant with time

94. The parameters which determine the friction factor for turbulent flow in a rough pipe are :

(a) Froude number and relative roughness

(b) Froude number and Mach number

(c) Reynold's number and relative roughness

(d) Mach number and relative roughness

95. The energy loss in pipelines is due to :
- viscous action only
  - surface roughness only
  - friction offered by pipe as well as viscous action
  - turbulent shear stress
96. Water hammer is a phenomenon caused by :
- sudden opening of a valve in pipeline
  - sudden closure of a valve in pipeline
  - incompressibility of fluid
  - pipe material being elastic
97. The flow is supersonic if the range of the Mach number (M) is :
- $M < 0.3$
  - $0.3 < M < 0.8$
  - $0.8 < M < 1.2$
  - $1.2 < M < 3$
98. The dimension of the Chezy's coefficient (c) are :
- $L^2 T^{-1}$
  - $LT^{-\frac{1}{2}}$
  - $M^0 L^0 T^0$
  - $L^{-\frac{1}{2}} T^{-1}$
99. The parameters which control the flow phenomenon of viscous compressible fluids are :
- Mach number and Reynold's number
  - Mach number and Prandtl number
  - Mach number, specific heat ratio, Reynold's number and Prandtl number
  - none of the above
100. One-dimensional method of flow analysis means :
- uniform flow
  - steady uniform flow
  - neglecting the variations in the transverse direction
  - neglecting the variations in the longitudinal direction
101. Stagnation point is where :
- pressure is zero
  - total energy is zero
  - flow velocity reduces to zero
  - none of the above
102. A pitot-tube is an instrument for measuring :
- pressure of flow
  - discharge of fluid
  - velocity of flow
  - total energy
103. The coefficient of discharge of a venturimeter lies within the limits :
- 0.7-0.9
  - 0.6-0.8
  - 0.75-0.95
  - 0.95-0.99
104. Cavitation in fluid flow occurs when :
- total energy suddenly increases
  - total energy suddenly decreases
  - pressure of flow decreases to a value close to its vapour pressure
  - velocity head reduces to zero



105. The momentum correction factor is used to account for :
- change in mass rate of flow
  - non-uniform distribution of velocities at inlet and outlet section
  - change in pressure
  - change in direction of flow
106. In the case of Buckingham's  $\pi$  theorem (m) repeating variables are selected from amongst (n) variables influencing the phenomenon. The repeating variables are selected such that :
- they in combination contain each of the (m) fundamentals dimensions involved
  - they belong to kinematic and dynamic category of variables
  - they must contain the dependent variables
  - none of the above
107. Kinematic similarity between model and prototype is :
- similarity of shape
  - similarity of streamline pattern
  - similarity of forces influencing the fluid motion
  - similarity of discharge
108. The time scale ratio for a model based on Froude's law criterion in terms of length scale ratio ( $l_e$ ) is :
- $l_r$
  - $\sqrt{l_r}$
  - $1/\sqrt{l_r}$
  - $l_e$

109. The boundary layer exists in :
- flow of ideal fluids
  - flow of real fluids
  - pipe flow
  - flow over flat surfaces
110. The laminar boundary-layer over a long flat plate becomes unstable and changes flow characteristics from laminar to turbulent when the plate Reynold's number approaches a value between :
- $2 \times 10^6 - 5 \times 10^6$
  - $3 \times 10^5 - 6 \times 10^5$
  - $3 \times 10^4 - 5 \times 10^4$
  - $5 \times 10^6 - 8 \times 10^6$
111. An ideal fluid is one which has/is :
- negligible surface tension
  - low density
  - non-viscous and incompressible
  - elastic and viscous
112. Newton's law of viscosity is a relationship between :
- shear stress and pressure
  - pressure and viscosity
  - shear stress and velocity gradients
  - pressure, temperature and shear stress

113. Absolute pressure in a flow system is :
- above, below or equal to local atmospheric pressure
  - always above local atmospheric pressure
  - a vacuum pressure
  - also a negative pressure
114. The point through which the resultant hydrostatic force acts is called :
- metacentre
  - centre of gravity
  - centre of buoyancy
  - centre of pressure
115. A floating body displaces a volume of liquid equal to :
- its own weight
  - its own volume
  - its submerged weight
  - none of the above
116. The flow in a river during period of heavy rainfall is :
- steady, uniform, two-dimensional
  - unsteady, non-uniform and three-dimensional
  - unsteady, uniform, three-dimensional
  - none of the above
117. Normal acceleration in flow situation (fluid) exists when :
- stream lines are straight and parallel
  - flow is two-dimensional
  - stream lines are curved
  - none of the above
118. Irrotational flow is characterized as the one in which :
- fluid flows along a straight path
  - fluid does not rotate as it moves along
  - net rotation of fluid particles about their mass centre remains zero
  - none of the above
119. The concept of stream function which is based on the principle of continuity is applicable to :
- three-dimensional flow
  - two-dimensional flow
  - uniform flow
  - all types of flow
120. A flownet is a graphical representation of streamline and equipotential lines such that :
- velocity potential increases in the direction of flow
  - indicates the direction and magnitude of
  - intersect each other orthogonally forming curvilinear squares
  - none of the above