# COMBINED COMPETITIVE (PRELIMINARY) EXAMINATION, 2010

**Serial No.**

## CIVIL ENGINEERING
### Code No. 05

**A**

*Time Allowed : Two Hours*

*Maximum Marks : 300*

## 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* responses (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 responses 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.

**ROUGH WORK**

1. In the case of colliding elastic (perfectly) bodies :
   (A) Static energy before impact = static energy after impact
   (B) Kinetic energy before impact = kinetic energy after impact
   (C) Static energy before impact = kinetic energy after impact
   (D) None of the above

2. The variation of bending moment due to UDL is :
   (A) Uniform in nature            (B) Linear in nature
   (C) Parabolic in nature          (D) Hyperbolic in nature

3. The longitudinal stress in a thin cylinder of mean radius R, wall thickness h, under pressure p is given by :
   (A) $\dfrac{pR}{h}$              (B) $\dfrac{pR}{2 \cdot h}$
   (C) $\dfrac{2\,pR}{h}$           (D) $\dfrac{p}{2 \cdot hR}$

4. The influence line diagram is a graph that represents a function like :
   (A) a reaction at a support          (B) the shear force at a section
   (C) the bending moment at a section  (D) all the above

5. The relationship between Modulus of Elasticity E, Modulus of Rigidity G, and Bulk Modulus K is given by :
   (A) $E = \dfrac{G + 3K}{9\,KG}$       (B) $E = \dfrac{3G + K}{9\,KG}$
   (C) $E = \dfrac{9\,KG}{G + 3\,K}$     (D) $E = \dfrac{9\,KG}{3G + K}$

6. Modulus of rigidity may be defined as the ratio of :
   (A) Longitudinal stress to longitudinal strain
   (B) Shearing stress to shearing strain
   (C) Longitudinal stress to shearing strain
   (D) Shearing stress to longitudinal strain

7. ……… is statically determinate structure.
   (A) Single hinged arch          (B) Two hinged arch
   (C) Three hinged arch           (D) Fixed arch

8. Principal planes are the planes on which maximum stress is the :
   (A) Shear stress
   (B) Normal stress
   (C) Tangential stress
   (D) Temperature stress

9. The flexural stress in a beam shall be lower if its :
   (A) Section modulus is quite low
   (B) Section modulus is quite high
   (C) Section modulus is zero
   (D) size is large

10. A soil has a discharge velocity of $6 \times 10^{-7}$ m/s and a void ratio of 0.50. Its Seepage velocity is :
    (A) $12 \times 10^{-7}$ m/s
    (B) $18 \times 10^{-7}$ m/s
    (C) $24 \times 10^{-7}$ m/s
    (D) $36 \times 10^{-7}$ m/s.

11. Critical hydraulic gradient in a saturated sand with water content 35% and specific gravity of solids 2.65, is :
    (A) 0·855
    (B) 1·170
    (C) 1·891
    (D) 0·529

12. The load carrying capacity of an individual function pile is 200 kN. The total load carrying capacity of a group of a such piles with group efficiency factor 0.8 is :
    (A) 1800 kN
    (B) 1640 kN
    (C) 1440 kN
    (D) 2250 kN

13. Total lateral earth pressure is proportional to
    (A) depth of soil
    (B) square of the depth of soil
    (C) angle of internal friction of soil
    (D) None of the above

14. If the coefficient of active earth pressure K is 1/3, then the coefficient of passive earth pressure is :
    (A) 1/3
    (B) 3/2
    (C) 1
    (D) 3

15. A soil mass is said to be in plastic equilibrium, if it is :
    (A) in plastic stage
    (B) at the verge of failure
    (C) stressed to maximum
    (D) excess of plastic limit.

16. The critical depth is the depth of flow at which :
    (A) the unit discharge is minimum
    (B) the unit discharge is maximum
    (C) the specific energy is minimum
    (D) the specific energy is maximum

17. When Froude's number is equal to unity, the flow in an open channel is called :
    (A) critical flow
    (B) tranquil flow
    (C) streaming flow
    (D) shooting flow

18. The hydraulic jump occurs in a channel when the bed slope :
    (A)  is adverse
    (B)  changes from mild to steep
    (C)  is reverse
    (D)  changes from steep to mild

19. Gradually varied flow is one in which :
    (A)  the depth changes gradually over a short distance
    (B)  the depth changes gradually over a long distance
    (C)  the width changes gradually over a short distance
    (D)  the width changes gradually over a long distance

20. Water hammer is caused by :
    (A)  Sudden opening of a valve in a pipeline
    (B)  Sudden closure of a valve in a pipeline
    (C)  Incompressibility of fluid
    (D)  Obstruction in a channel

21. The boundary layer separation starts occurring when :

    (A)  $\dfrac{dp}{dx} < 0$
    (B)  $\left(\dfrac{\delta u}{\delta y}\right)_{y=0} > 0$

    (C)  $\left(\dfrac{\partial u}{\partial y}\right)_{y=0} = 0$
    (D)  $\dfrac{d^2 p}{dx^2} = -\,ve$

22. The drag force is given by :
    (A)  $C_D\, \rho\, U^2 A$
    (B)  $C_D\, \rho^2\, U^2 A$

    (C)  $C_D\, \rho\, U^2 A^2$
    (D)  $C_D\, \dfrac{\rho U^2}{2}\, A$

23. A well shaped triangle must have angles :
    (A)  greater than 30º and less than 120º
    (B)  less than 30º and more than 120º
    (C)  equally
    (D)  between 75º and 110º.

24. Chainage and offset are
    (A)  two instruments used in chain survey
    (B)  longitudinal and lateral distances
    (C)  numbers given chain survey
    (D)  distances measured on a chain line.

25. The bearings of two lines AB and AC are N 90º W and S 90º W respectively. The included angle BAC will be :
(A) 180º                                 (B) 90º
(C) 0º                                   (D) None of the above

26. The FB of a line AB is N 40 ºE and the BB of the same line AB is S 40º W, the value of local attraction is :
(A) 40º                                  (B) 0º
(C) 50º                                  (D) None of the above

27. The size of the theodolite is determined by measuring :
(A) the height of theodolite above the stand
(B) the height of theodolite above ground level
(C) the diameter of the horizontal circle
(D) the length and breadth of the theodolite box.

28. The number of fundamental lines of a Transit theodolite are :
(A) 2                                    (B) 4
(C) 6                                    (D) 8

29. The shift of the curve is calculated by using the relation :
(A) $S = \dfrac{L^2}{24R}$                 (B) $S = \dfrac{R}{24L^2}$

(C) $S = \dfrac{L^2R}{24}$                 (D) $S = \dfrac{L}{24R}$

30. Coordinate system for locating Heavenly bodies on Celestial sphere is :
(A) Declination and hour angle           (B) Altitude and azimuth
(C) Right ascension and declination      (D) All of the above

31. The fixed end moment at left end of a fixed beam of length 'L' subjected to concentrated load 'W' at a distance 'a' from left support and 'b' from right support (L = a + b) is :
(A) $\dfrac{Wa^2b}{L^2}$                   (B) $\dfrac{Wa\,b^2}{L^2}$

(C) $\dfrac{Wa\,b}{L}$                     (D) None of these

32. A two hinged parabolic arch of span L and central rise h is represented by the equation :

(A) $y = \dfrac{4hx}{L^2}(L - x)$

(B) $y = \dfrac{4hL}{x^2}(x - L)$

(C) $y = 4hx^2$

(D) None of these

33. In a two hinged parabolic arch of span L and central rise h, the moment at inertia varies as $I = I_o \sec \theta$ where $I_o$ is moment of inertia at the crown. The horizontal thrust far this arch is given by :

(A) $H = \dfrac{\int M'y\,dx}{\int y\,dx}$

(B) $H = \dfrac{\int M'y^2\,dx}{\int y^2\,dx}$

(C) $H = \dfrac{\int M'y\,dx}{\int y^2\,dx}$

(D) None of the above

34. For a two hinged parabolic arch of span L and central rise h, the influence line diagram for horizontal thrust 'H' is :
(A) Triangular
(B) Parabolic
(C) Rectangular
(D) None of the above

35. In a truss carrying a load system, if two forces act at a joint and are in straight line, then to ensure the equilibrium of the joint :
(A) these two forces should be equal and opposite
(B) these two forces should be perpendicular to each other
(C) these two forces should be at 45° to each other
(D) None of these is true

36. Unit load method can be used to find :
(A) Forces in members one by one
(B) Forces in all the members at a time
(C) Deflection of all joints at a time
(D) Deflection of a single joint at a time

37. The vertical reaction at either end of a fixed beam undergoing sinking Δ (of a support with respect to other) is given by :

(A) $\dfrac{6\,EI\,\Delta}{\ell^2}$

(B) $\dfrac{3\,EI\,\Delta}{\ell^2}$

(C) $\dfrac{12\,EI\,\Delta}{\ell^3}$

(D) $\dfrac{6\,EI\,\Delta}{\ell^3}$

38. The absolute stiffness of a member with far end hinged condition is :

(A) $\dfrac{4\,EI}{\ell}$

(B) $\dfrac{6\,EI}{\ell}$

(C) $\dfrac{8\,EI}{\ell}$

(D) $\dfrac{3\,EI}{\ell}$

39. The ratio of the moment required to produce a given rotation at one end with far end fixed and hinged condition respectively is
    (A) 4/3
    (B) 3/4
    (C) 1/2
    (D) None of these

40. The matrix stiffness method is also called as
    (A) Force method
    (B) Displacement method
    (C) Approximate method
    (D) None of these

41. In a fully saturated soil a reduction in volume is possible only for
    (A) Compression of water
    (B) Expulsion of water from voids
    (C) Compression of soil skeleton
    (D) None of these

42. The unconfined compression test is a special type of
    (A) vane shear test
    (B) unconfined undrained triaxial test
    (C) unconfined undrained direct shear test
    (D) drained triaxial test

43. Depth of embedment of anchored sheet pipe wall is determined by adopting
    (i) elastic line method, (ii) fixed earth support method, (iii) cantilever method, and (iv) Equilibrium beam method
    (A) (i), (ii) and (iii) are correct
    (B) (ii), (iii) and (iv) are correct
    (C) (iii), (iv) and (i) are correct
    (D) (iv), (i) and (ii) are correct

44. The best representation of bearing capacity factor $N_r$ with respect to unit weight of soil for shallow foundation is
    (A) $N_r = 4 \cdot 5\,(N_q + 1)\tan\theta$
    (B) $N_r = 5 \cdot 7\,(N_q - 1)\tan\theta$
    (C) $N_r = 6 \cdot 1\,(N_q + 1)\tan\theta$
    (D) $N_r = 2\,(N_q + 1)\tan\theta$
    where $N_q$ is bearing capacity factor with respect to surcharge and $\theta$ is the angle of internal friction.

45. Hot wire anemometer is used to measure
    (A) discharge
    (B) pressure intensity of gas
    (C) velocity of gas
    (D) pressure intensity of liquid

46. For a two dimensional flow having $\phi = 3xy$, the velocity components at (1, 3) are
    (A) 9, –3
    (B) –9, 3
    (C) –9, –3
    (D) 9, 3

47. The relationship between Manning's coefficient n and Chezy's coefficient C is given by :

    (A) $C = \dfrac{R^{2/3}}{n}$
    (B) $C = \dfrac{R^{1/6}}{n}$

    (C) $C = \dfrac{R^{1/3}}{n}$
    (D) $C = \dfrac{R^{1/4}}{n}$

48. If Fr is the Froud number for a flow in triangular channel then the Froude number for the same velocity and same depth of flow in a rectangular channel is

    (A) Fr
    (B) $\dfrac{Fr}{\sqrt{2}}$

    (C) $\sqrt{2}$ Fr
    (D) $\dfrac{Fr}{\sqrt{3}}$

49. In an optical square, the mirrors are fixed at an angle of
    (A) 30°
    (B) 45°
    (C) 60°
    (D) 90°

50. The correction for a length of 30 m along a slope of 1 in 20 is equal to
    (A) 7·5 cm
    (B) 3·75 cm
    (C) 2·5 cm
    (D) 1·25 cm

51. The value of dip at the magnetic pole is
    (A) 0°
    (B) 45°
    (C) 30°
    (D) 90°

52. The algebraic sum of departure and latitude in a closed traverse must be :
    (A) greater than zero
    (B) less than zero
    (C) equal to zero
    (D) None of these

53. If the face left and face right observations of a theodolite differs by 3', the error is equal to :
    (A) 6'
    (B) 3'
    (C) 1' 30"
    (D) 0'

54. If 'f' (the focal length) of the object glass is 24 cm and the spacing of cross-hair stadia diaphragm is 12 mm, then the multiplying constant is :
    (A) 0·05
    (B) 0·005
    (C) 200
    (D) 20

55. For a transition curve, total angle of deflection is :
    (A) spiral angle /2
    (B) 2∗ spiral angle
    (C) spiral angle /3
    (D) 3∗ spiral angle

56. Length of the transition curve is equal to :
    (A) $v^3/CR$
    (B) $v^2/CR$
    (C) $v/CR$
    (D) $\sqrt{v}/CR$
    where, v is the velocity, R is the radius of circular curve and C is the rate of change of radial acceleration.

57. Which of the following is an ideal transition curve ?
    (A) parabolic curve
    (B) cubical curve
    (C) clothoid curve
    (D) None of these

58. The curl of a vector :
    (A) may or may not be a vector
    (B) refers to the rotationality of the vector field
    (C) refers to the efflux of the vector
    (D) Vanishes if the vector has a constant magnitude

59. The resultant of a system of forces in a plane is always :
    (A) a single force
    (B) a single moment
    (C) a single force or single moment
    (D) a single force and a single moment

60. The moment of inertia of a body is :
    (A) the moment of its inertia
    (B) the rotational moment acting on the body
    (C) the rotational analogue of mass
    (D) None of these

61. The frame shown below is statically indeterminate to :
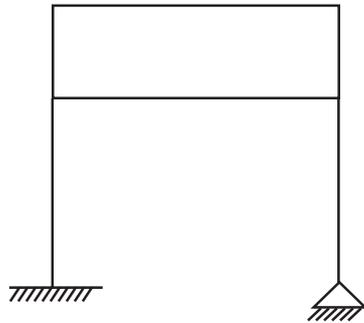


    (A) third degree              (B) fifth degree
    (C) sixth degree              (D) eleventh degree

62. A vibratory compactor is used for the compaction of :
    (A) cohesive soils            (B) granular soils
    (C) both (A) and (B)          (D) None of these

63. The ratio of undisturbed shear strength to the shear strength of remoulded soil is known as :
    (A) sensitivity               (B) activity
    (C) both (A) and (B)          (D) None of these

64. The column analogy method is applicable for the indeterminate structure having maximum redundancy equal to :
    (A) 1                         (B) 2
    (C) 3                         (D) No limitation

65. The process of consolidation will be
    (A) quicker in a fine grained soil
    (B) quicker in a coarse grained soil
    (C) The same in both fine-grained and coarse-grained soils
    (D) None of these

66. For a beam carrying a uniformly distributed load, the strain energy will be maximum in case the beam is:
(A) Cantilever  (B) Simply supported
(C) Propped cantilever  (D) fixed at both ends

67. The shear equation for the portal frame as shown in fig. is :
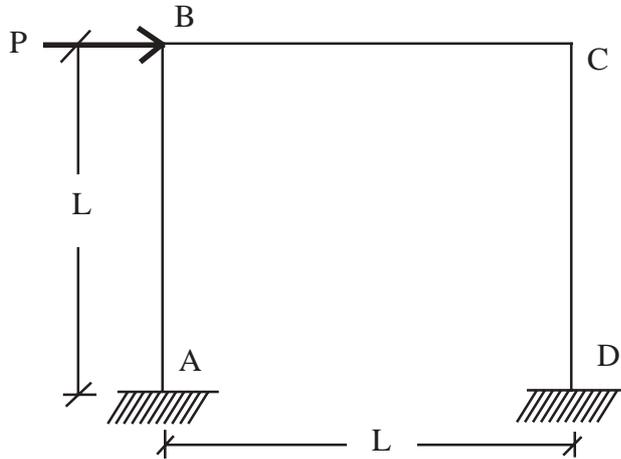


(A) $\dfrac{M_{AB} + M_{BA}}{L} + \dfrac{M_{CD} + M_{DC}}{L} + P = 0$

(B) $\dfrac{M_{AB} + M_{BA}}{L} + \dfrac{M_{BC} + M_{CB}}{L} + P = 0$

(C) $\dfrac{M_{BC} + M_{CB}}{L} + \dfrac{M_{CD} + M_{DC}}{L} + P = 0$

(D) None of these

68. The Colebrook-white formula for pipe friction is for :
(A) artificially roughened pipes
(B) commercial pipes
(C) pipes coated with non-uniform sand
(D) pipes coated with uniform sand

69. In a hydraulically most efficient Rectangular channel section the ratio of the bed width to depth is :
(A) 0·50  (B) 2·0
(C) 1·0  (D) 1·15

70. A laminar boundary layer has a velocity distribution given by $u/U = y/\delta$. The displacement thickness $\delta^*$ for this boundary layer is :
(A) $\delta$  (B) $\delta/2$
(C) $\delta/4$  (D) $\delta/6$

71. If the velocity u in a turbulent boundary layer varies as $y^{1/7}$, the growth of the boundary layer thickness $\delta/x$ varies as

(A) $Re_x^{-1/5}$

(B) $Re_x^{-1/2}$

(C) $Re_x^{-4/5}$

(D) $Re_x^{-1}$

72. In a turbulent flow through a pipe of radius "$r_0$" the radial distance at which the local velocity is equal to the mean velocity is

(A) $r = 0$

(B) $\cdot223\ r_0$

(C) $\cdot777\ r_0$

(D) $\cdot5\ r_0$

73. Pa-s is unit of :

(A) Surface Tension

(B) Kinematic viscosity

(C) Pressure

(D) Dynamic viscosity

74. An iceberg has 12% of its volume projecting above the surface of the sea. If the density of sea water is 1025 kg/m$^3$, the density of the iceberg is :

(A) 878 kg/m$^3$

(B) 1000 kg/m$^3$

(C) 1148 kg/m$^3$

(D) 902 kg/m$^3$

75. The Reynolds number for flow of an oil in a certain pipe is 640. The Darcy-Weisbach friction factor f for this flow is :

(A) 0·02

(B) 0·01

(C) 0·1

(D) ·064

76. The permissible error in chaining for measurement with a chain on rough or hilly ground is :

(A) 1 in 100

(B) 1 in 250

(C) 1 in 500

(D) 1 in 1000

77. If the back bearing of a line is N 30° W, its fore bearing is :

(A) S 30° W

(B) S 30° E

(C) N 30° E

(D) N 30° W

78. Correction due to refraction (in m) is given by :

(A) 0·0112 D$^2$

(B) 0·0785 D$^2$

(C) 0·0673 D$^2$

(D) 0·0012 D$^2$

where D is the horizontal distance between the object and instrument in km.

79. A subtense bar is used to measure :

(A) Horizontal Distance

(B) Vertical Distance

(C) Horizontal Angle

(D) Vertical Angle

80. The radius of simple circular curve is 30 m and the length of the specified chord is 30 m. The degree of the curve is :
(A) 57·29
(B) 3·70
(C) 55·60
(D) 37·03

81. If the resultant of two forces has the same magnitude as either of the force then the angle between the two forces is :
(A) 30°
(B) 45°
(C) 60°
(D) 120°

82. The centre of gravity of a hemisphere of radius r from its base measured along the vertical radius is :

(A) $\dfrac{4r}{3}$
(B) $\dfrac{3r}{2}$

(C) $\dfrac{3r}{8}$
(D) $\dfrac{4r}{7}$

83. If the angular rotation $\theta = 2t^3 - 3t^2$, the angular acceleration at $t = 1s$ is :
(A) 1 rad / s²
(B) 4 rad / s²
(C) 6 rad / s²
(D) 12 rad / s²

84. For a given velocity of a projectile, the range is maximum when the angle of projection is :
(A) 30°
(B) 90°
(C) 45°
(D) 57°

85. The shape of a suspended cable for a uniformly distributed load over (if the sag to span ratio is small) it is :
(A) circular
(B) parabolic
(C) catenary
(D) cubic parabola

86. An internal hinge or roller support in a real beam becomes ......... in its conjugate beam.
(A) an internal hinge
(B) a roller support
(C) free
(D) a fixed support

87. What is the degree of static in determinacy of the frame shown in figure ?



(A) 5
(B) 4
(C) 3
(D) 6

88. When a uniformly distributed load shorter than span of a simply supported beam crosses it, then maximum bending moment at a section occurs when position of load is such that :
   (A) section divides the load in the same ratio as it divides the span
   (B) head or tail of the load is at the section
   (C) section divides the load in two equal parts
   (D) load is placed symmetrically on span

89. Force in member AB of a truss shown in figure is :
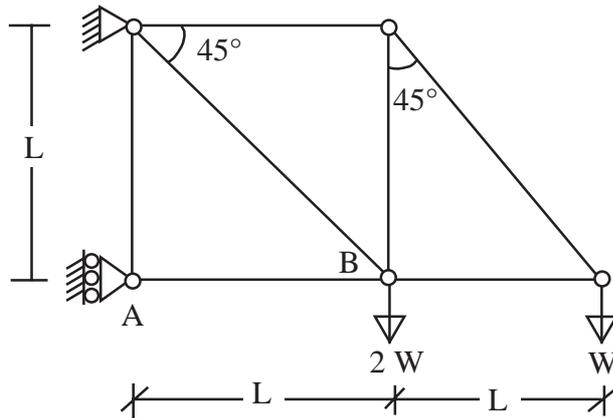


   (A) 2 W                                    (B) Zero
   (C) 4 W                                    (D) $\sqrt{2}$ W

90. The variation of bending moment along the length of central column of the frame shown in figure is :
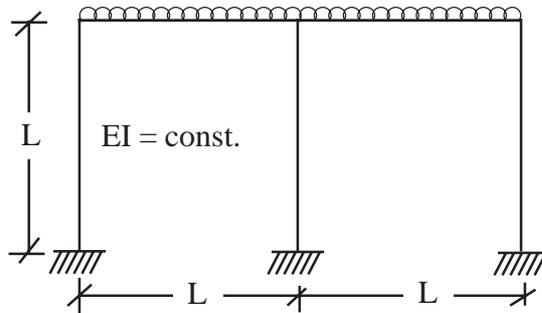


   (A) rectangular                            (B) triangular
   (C) parabolic                              (D) zero throughout

91. A linear arch has :
   (A) normal thrust only                     (B) shear force only
   (C) bending moment only                    (D) normal thrust and shear force

92. The ratio of maximum shear stress to the average shear stress in a circular section is :
(A) 9/8
(B) 4/3
(C) 3/2
(D) 5/4

93. For a body subjected to hydrostatic state of stress, the shear stress on a plane inclined at an angle of 45° with the horizontal is :
(A) maximum
(B) zero
(C) minimum
(D) one third of hydrostatic pressure

94. If the deflection at the free end of a uniformly loaded cantilever beam of length 1 m is equal to 7·5 mm, then the slope at the free end is :
(A) 0·01 rad
(B) 0·015 rad
(C) 0·02 rad
(D) none of the above

95. In a solid rectangular shaft subjected to torsion, the maximum shear stress occurs at :
(A) centre
(B) corners
(C) mid of smaller side
(D) mid of longer side

96. Angle of dip at equator is :
(A) 0°
(B) 90°
(C) 45°
(D) 30°

97. A 10 cm theodolite means that :
(A) The length of telescope is 10 cm
(B) The height of telescope is 10 cm
(C) The diameter of Graduated circle of its lower plate is 10 cm
(D) The diameter of Graduated circle of its vertical circle is 10 cm

98. Spire test is used for adjustment of :
(A) Line of sight
(B) Horizontal Axis
(C) Vertical Axis
(D) Adjustment of Altitude bubble

99. The combined curvature and refraction correction for 1 km distance is :
(A) 0·0112 m
(B) 0·0673 m
(C) 1·120 m
(D) 6·73 m

100. In a closed traverse of n sides, the theoretical sum of included angles should be :
(A) $(2n - 4) \times 90$
(B) $(2n + 4) \times 90$
(C) $(2n + 3) \times 90$
(D) 360°

101. Which pair is not correctly matched ?
    (A) Casagrande's Apparatus                    Liquid Limit
    (B) Pyenometer                                Specific Gravity
    (C) Oedometer                                 Coeff. of Consolidation
    (D) Vane shear test                           Angle of Internal friction

102. Volumetric expansion of soil due to shear in a drained shear test is called :
    (A) Thixotropy                                (B) Swelling
    (C) Dilatancy                                 (D) Creep

103. The possibility of Quick sand condition is when flow of water to soil is :
    (A) Horizontal                                (B) Upward
    (C) Downward                                  (D) Radial

104. Liquid Limit of a soil indicates its :
    (A) Compressibility                           (B) Permeability
    (C) OMC                                       (D) Shear Strength

105. Law used in Permeability test is :
    (A) Darcy Law                                 (B) Stokes Law
    (C) Newton Law                                (D) Pascal Law

106. The viscosity of :
    (A) liquid increases with increase in temperature
    (B) gases increases with increase in temperature
    (C) gases decrease with increase in temperature
    (D) None of the above

107. If the relationship between the shear stress $\tau$ and the rate of shear strain $\dfrac{du}{dy}$ is expressed

    as $\tau = K\left[\dfrac{du}{dy}\right]^n$, the fluid with the exponent $n < 1$ is known as :
    (A) Pseudoplastic fluid                       (B) Bingham fluid
    (C) Dilatant fluid                            (D) Newtonian fluid

108. A streamline is a line :
    (A) which is normal to the velocity vector at every point
    (B) which represents lines of constant velocity potential
    (C) which is normal to the lines of constant stream function
    (D) which is tangential to the velocity vector everywhere at a given instant

109. If $\psi = 2xy$, the magnitude of the velocity vector at $(2, -2)$ is :

(A) $\sqrt{2}$      (B) 4

(C) $-8$      (D) $\sqrt{2}$

where $\psi$ is stream function.

110. Bernoulli equation is applicable between two points :

(A) In any rotational flow of an incompressible fluid

(B) In any type of irrotational flow of a fluid

(C) In steady rotational flow of an incompressible fluid

(D) In steady, irrotational flow of an incompressible fluid

111. Which of the following is not a dimensionless number ?

(A) Darcy-Weisback friction factor "f"

(B) Coefficient of drag "$C_D$"

(C) Manning's coefficient "n"

(D) Coefficient of velocity "$C_V$"

112. In a 1/60 model of a spillway the discharge was measured as $0{\cdot}150$ m³/s. The corresponding prototype discharge in m³/s is :

(A) 4183      (B) 2789

(C) 32400      (D) 5400

113. The momentum correction factor $\beta$ for laminar flow through a circular pipe is :

(A) $1{\cdot}5$      (B) $2{\cdot}0$

(C) $1{\cdot}67$      (D) $1{\cdot}33$

114. In laminar flow between two fixed parallel plates the shear stress is :

(A) Constant across the passage

(B) Maximum at centre and zero at the boundary

(C) Zero all through the passage

(D) Maximum at the boundary and zero at the centre

115. In a hydrodynamically smooth surface the roughness magnitude K and laminar sublayer layer thickness $\delta'$ are related as :

(A) $K/\delta' > 1{\cdot}0$      (B) $K/\delta' < 0{\cdot}25$

(C) $K/\delta' \geq 6{\cdot}0$      (D) $K/\delta' = 1/30$

116. In a turbulent flow through a pipe the mean velocity is 3·61 m/s and the friction factor f = 0·02. The shear velocity of the flow in m/s :
    (A)  3·610                        (B)  0·180
    (C)  2·725                        (D)  0·482

117. In the Moody diagram the values of f for turbulent flow are based on :
    (A)  Nikuradse's uniform sand grain data
    (B)  Data on non-uniform sand grains coated to pipe
    (C)  Colebrook-white data on commercial pipes
    (D)  Hazen-William pipe flow formula

118. In a sudden explain, loss of head is given by the :
    (A)  $(V_1^2 - V_2^2)/2_g$                (B)  $0 \cdot 5(V_1 - V_2)^2/2g$
    (C)  $(V_1 - V_2)^2/2g$                    (D)  $0 \cdot 5 \, V_2^2/2g$

119. A rectangular channel of 4 m width conveys water at 8 m³/s under critical condition. The specific energy for this flow is :
    (A)  0·742 m                      (B)  1·488 m
    (C)  0·370 m                      (D)  1·112 m

120. A triangular channel with side slopes of 1·5 H : IV carries a discharge of 2m³/s. The critical depth for this flow is :
    (A)  1·129 m                      (B)  0·816 m
    (C)  0·742 m                      (D)  0·711 m

**ROUGH WORK**