TEST BOOKLET — (CIVIL ENGINEERING)

1. The relationship between Young's modulus (E), modulus of rigidity (G) and Poisson's ratio (μ) is
   (A) $E = 2G(1 + \mu)$
   (B) $E = 2G(1 - \mu)$
   (C) $E = G(1 + 2\mu)$
   (D) $E = G(1 - 2\mu)$

2. A simply supported beam of span L carries a central point load W. The maximum bending moment is
   (A) WL/4
   (B) WL/8
   (C) WL/2
   (D) WL/6

3. The section modulus of a rectangular section of width b and depth d is
   (A) $bd^2/6$
   (B) $bd^2/12$
   (C) $b^2d/6$
   (D) $bd^3/12$

4. When a material is subjected to equal and opposite axial forces, the stress produced is called
   (A) Shear stress
   (B) Bending stress
   (C) Direct stress
   (D) Torsional stress

5. The slenderness ratio of a column is defined as the ratio of
   (A) Effective length to radius of gyration
   (B) Actual length to width
   (C) Radius of gyration to area
   (D) Width to depth

6. The phenomenon of lateral buckling is associated with
   (A) Short columns
   (B) Long columns
   (C) Beams under torsion
   (D) Slabs under bending

7. For a circular shaft of diameter d, the polar moment of inertia is
   (A) $\pi d^4/32$
   (B) $\pi d^4/64$
   (C) $\pi d^3/16$
   (D) $\pi d^3/32$

8. The elastic curve of a beam is governed by
   (A) $EI\,(d^2y/dx^2) = M$

(B) $EI (d^2y/dx^2) = -M$
(C) $EI (dy/dx) = M$
(D) $EI\ y = M$

9. Resilience of a material is defined as
(A) Ability to absorb energy without plastic deformation
(B) Ability to absorb maximum energy before fracture
(C) Resistance to wear
(D) Resistance to impact

10. For a thin-walled pressure vessel, hoop stress is
(A) $pd/4t$
(B) $pd/2t$
(C) pd/t
(D) $2pd/t$

11. The number of reactive components in a propped cantilever beam is
(A) 2
(B) 3
(C) 4
(D) 5

12. For a fixed beam of span L with UDL of w per unit length, the fixing moment at each support is
(A) $wL^2/8$
(B) $wL^2/12$
(C) $wL^2/16$
(D) $wL^2/24$

13. The degree of static indeterminacy of a fixed beam is
(A) 1
(B) 2
(C) 3
(D) 4

14. Fatigue failure of a material occurs due to
(A) Static load beyond elastic limit
(B) Repeated cyclic loading
(C) Single impact load
(D) Thermal stress

15. The maximum shear stress in a circular shaft of radius r subjected to torque T is
(A) $T/\pi r^3$
(B) $2T/\pi r^3$
(C) $T/2\pi r^3$
(D) $4T/\pi r^3$

16. The modular ratio (m) in concrete design is the ratio of
(A) E of steel to E of concrete
(B) E of concrete to E of steel
(C) Stress in steel to stress in concrete
(D) Area of steel to area of concrete

17. The neutral axis of a T-beam is located
    (A) Always in the flange
    (B) Always in the web
    (C) Depends on dimensions
    (D) Always at mid depth

18. Clapeyron's theorem of three moments is used for
    (A) Continuous beams
    (B) Fixed beams
    (C) Cantilever beams
    (D) Propped cantilevers

19. The unit of flexural rigidity is
    (A) $N \cdot m$
    (B) $N \cdot m^2$
    (C) N/m
    (D) N/m^2

20. In a beam, the point of contraflexure is a point where
    (A) Shear force is zero
    (B) Bending moment is maximum
    (C) Bending moment changes sign
    (D) Deflection is maximum

21. The Muller-Breslau principle is used for drawing
    (A) Influence lines
    (B) Bending moment diagrams
    (C) Shear force diagrams
    (D) Deflection curves

22. The carry-over factor for a far fixed end in moment distribution method is
    (A) 0
    (B) 0.5
    (C) 1
    (D) -0.5

23. The stiffness factor for a far end pinned member is
    (A) 4EI/L
    (B) 3EI/L
    (C) 2EI/L
    (D) EI/L

24. In slope deflection method, the unknown quantities are
    (A) Slopes and deflections at joints
    (B) Moments at joints
    (C) Reactions at supports
    (D) Shear forces at joints

25. A two-hinged arch is
    (A) Statically determinate

(B) Statically indeterminate of first degree
(C) Statically indeterminate of second degree
(D) A mechanism

26. The horizontal thrust in a parabolic arch carrying a UDL on full span
(A) Depends on rise of arch
(B) Is zero
(C) Depends only on span
(D) Is always maximum at crown

27. Virtual work principle is based on the concept of
(A) Conservation of momentum
(B) Conservation of energy
(C) D'Alembert's principle
(D) Newton's third law

28. The degree of kinematic indeterminacy of a pin-jointed truss with j joints and m members is
(A) $2j - m$
(B) $m - 2j + 3$
(C) $2j - m - 3$
(D) $m + 2j$

29. In Kani's method, the rotation factor is
(A) $-1/2 \times$ (stiffness/sum of stiffnesses)
(B) $-1/4 \times$ (stiffness/sum of stiffnesses)
(C) (stiffness/sum of stiffnesses)
(D) $2 \times$ (stiffness/sum of stiffnesses)

30. Betti's theorem states the relationship between
(A) Deflection and rotation
(B) Deflection due to one load set and another
(C) Shear force and bending moment
(D) Stiffness and flexibility

31. The specific gravity of soil solids typically ranges between
(A) 1.5 - 2.0
(B) 2.0 - 2.4
(C) 2.6 - 2.8
(D) 3.0 - 3.5

32. The void ratio of a fully saturated soil with water content w and specific gravity G is
(A) wG
(B) w/G
(C) G/w
(D) $w + G$

33. In a standard Proctor test, the energy imparted is approximately
(A) 296 kJ/m^3
(B) 593 kJ/m^3
(C) 2700 kJ/m^3
(D) 600 kJ/m^3

34. The liquid limit of soil is determined using
    (A) Casagrande's apparatus
    (B) Hydrometer
    (C) Pycnometer
    (D) Vicat apparatus

35. Quick sand condition occurs when the critical hydraulic gradient equals
    (A) $G - 1$
    (B) $(G - 1)/(1 + e)$
    (C) $(G + 1)/(1 + e)$
    (D) $(1 + e)/(G - 1)$

36. The shear strength of a purely cohesive soil is governed by
    (A) φ only
    (B) c only
    (C) Both c and φ
    (D) Neither c nor φ

37. The coefficient of earth pressure at rest (K_o) for a normally consolidated clay is
    (A) $1 - \sin \varphi$
    (B) $1 + \sin \varphi$
    (C) $(1 - \sin \varphi)/(1 + \sin \varphi)$
    (D) $\sin \varphi$

38. Consolidation settlement is primarily due to
    (A) Elastic compression of soil grains
    (B) Expulsion of water from voids
    (C) Compression of air in voids
    (D) Shear deformation

39. Terzaghi's bearing capacity factor Nq for $\varphi = 0$ is equal to
    (A) 0
    (B) 1
    (C) 5.14
    (D) $\pi + 2$

40. The Atterberg limits used for soil classification are
    (A) Liquid limit and plastic limit only
    (B) Liquid limit, plastic limit and shrinkage limit
    (C) Plastic limit and shrinkage limit only
    (D) Liquid limit and shrinkage limit only

41. A soil with uniformity coefficient $Cu < 2$ is considered
    (A) Well graded
    (B) Poorly graded
    (C) Gap graded
    (D) Broadly graded

42. The sensitivity of a clay is the ratio of
    (A) Undisturbed strength to remoulded strength

(B) Remoulded strength to undisturbed strength
(C) Peak strength to residual strength
(D) Residual to peak strength

43. Preconsolidation pressure is determined from
(A) Mohr's circle
(B) Flow net
(C) e-log p curve
(D) Vane shear test

44. Which of the following is a method for improving bearing capacity of soil?
(A) Preloading
(B) Dewatering
(C) Vibrofloatation
(D) All of the above

45. The critical depth in a deep excavation is determined by
(A) Rankine's theory
(B) Coulomb's theory
(C) Peck's method
(D) Bishop's method

46. The ratio of stress increment to strain increment in consolidation is called
(A) Compression index
(B) Coefficient of volume change
(C) Swelling index
(D) Coefficient of consolidation

47. A normally consolidated clay has an OCR of
(A) Less than 1
(B) Equal to 1
(C) Greater than 1
(D) Greater than 2

48. In a triaxial test, the deviator stress is
(A) $\sigma_1 - \sigma_3$
(B) $\sigma_1 + \sigma_3$
(C) $\sigma_1 \times \sigma_3$
(D) σ_1/σ_3

49. The geosynthetic material used for reinforced earth walls is
(A) Geomembrane
(B) Geogrid
(C) Geonet
(D) Geocomposite

50. The driving formula for pile capacity (Engineering News Record) gives
(A) Static capacity only
(B) Dynamic capacity only
(C) Both static and dynamic
(D) Lateral capacity

51. The continuity equation for steady incompressible flow is
    (A) $\partial u/\partial x + \partial v/\partial y + \partial w/\partial z = 0$
    (B) $\partial u/\partial x + \partial v/\partial y + \partial w/\partial z =$ constant
    (C) $\partial \rho/\partial t + \nabla \cdot (\rho V) = 0$
    (D) $\nabla \times V = 0$

52. The velocity of flow in a pipe is measured by
    (A) Piezometer
    (B) Pitot tube
    (C) Venturimeter
    (D) Both B and C

53. The hydraulic gradient line (HGL) for a pipeline lies
    (A) Above the total energy line
    (B) Below the total energy line
    (C) Coincides with total energy line
    (D) Parallel to the pipe axis always

54. For laminar flow in a pipe, the Darcy-Weisbach friction factor f is
    (A) 64/Re
    (B) 0.316/Re^0.25
    (C) Constant
    (D) Depends only on roughness

55. The momentum correction factor (β) for laminar flow in a pipe is
    (A) 1.0
    (B) 1.33
    (C) 1.5
    (D) 2.0

56. Cavitation in hydraulic machines occurs when local pressure falls below
    (A) Atmospheric pressure
    (B) Vapour pressure
    (C) Stagnation pressure
    (D) Dynamic pressure

57. The net positive suction head (NPSH) concept is associated with
    (A) Turbines
    (B) Pumps
    (C) Both A and B
    (D) Notches

58. In a Francis turbine, the flow is
    (A) Axial
    (B) Radial inward then axial
    (C) Radial outward
    (D) Tangential

59. The specific speed of a turbine is defined as the speed at which
    (A) Power output is maximum

(B) A geometrically similar turbine produces unit power under unit head
(C) Discharge is unity
(D) Head is unity

60. The discharge through a rectangular notch is proportional to
(A) H
(B) H^(3/2)
(C) H^(5/2)
(D) H^2

61. For a V-notch (triangular notch) of angle θ, the discharge is proportional to
(A) H^(3/2)
(B) H^(5/2)
(C) tan(θ/2)
(D) Both B and C

62. The coefficient of discharge for a standard orifice is typically
(A) 0.97 - 0.99
(B) 0.61 - 0.65
(C) 0.82 - 0.88
(D) 0.50 - 0.55

63. The dimensionless number used for ship models is
(A) Reynolds number
(B) Froude number
(C) Weber number
(D) Mach number

64. In open channel flow, the Chezy formula relates velocity to
(A) Hydraulic radius and friction slope
(B) Depth and width
(C) Discharge and area
(D) Energy and momentum

65. The hydraulic jump occurs when flow changes from
(A) Laminar to turbulent
(B) Sub-critical to super-critical
(C) Super-critical to sub-critical
(D) Uniform to non-uniform

66. For maximum velocity of flow in a circular conduit (partially full), the depth equals approximately
(A) 0.81D
(B) 0.94D
(C) 0.75D
(D) D (full)

67. The equation of momentum for open channel flow is known as
(A) Chezy equation
(B) Manning's equation
(C) Dynamic equation of GVF
(D) Continuity equation

68. The ratio of wave velocity to flow velocity is the
    (A) Reynolds number
    (B) Froude number
    (C) Weber number
    (D) Euler number

69. In a boundary layer over a flat plate, separation is more likely with a
    (A) Favourable pressure gradient
    (B) Zero pressure gradient
    (C) Adverse pressure gradient
    (D) Uniform velocity profile

70. The drag on a sphere in Stokes' law regime is proportional to
    (A) V
    (B) V^2
    (C) V^(1/2)
    (D) 1/V

71. The closing error in a theodolite traverse is distributed by
    (A) Bowditch's rule
    (B) Transit rule
    (C) Both A and B can be used
    (D) Neither A nor B

72. The angular measurement in surveying is done by
    (A) Chain
    (B) Theodolite
    (C) Level
    (D) Planimeter

73. Bench mark (BM) is a point of known
    (A) Distance
    (B) Elevation
    (C) Bearing
    (D) Coordinates

74. The combined correction for curvature and refraction for a distance d is
    (A) $0.0673\ d^2$
    (B) $0.0112\ d^2$
    (C) $0.0785\ d^2$
    (D) $0.1d^2$

75. The reduced bearing of a line S 40° W is expressed in whole circle bearing as
    (A) 220°
    (B) 140°
    (C) 40°
    (D) 320°

76. In plane table surveying, the method used for inaccessible points is
    (A) Radiation

(B) Intersection
(C) Traversing
(D) Resection

77. The sensitiveness of a level tube is expressed in terms of
(A) Radius of curvature of bubble tube
(B) Length of one division
(C) Angle per division
(D) All of the above

78. The error due to non-adjustment of line of collimation in a level is called
(A) Parallax error
(B) Error of collimation
(C) Index error
(D) Personal error

79. The chain used in India for revenue surveys is
(A) Gunter's chain
(B) Engineer's chain
(C) Revenue chain
(D) Metric chain

80. For a simple circular curve, the tangent length is given by
(A) $R \tan(\Delta/2)$
(B) $R \sin(\Delta/2)$
(C) $R (1 - \cos(\Delta/2))$
(D) $R \Delta/2$

81. The mid-ordinate of a circular curve is
(A) $R(1 - \cos(\Delta/2))$
(B) $R \tan(\Delta/2)$
(C) $R \sin(\Delta/2)$
(D) $R(\sec(\Delta/2) - 1)$

82. EDM stands for
(A) Electronic Distance Measurement
(B) Exact Depth Measurement
(C) Engineering Data Management
(D) Elevation and Distance Mapping

83. Remote sensing uses which type of energy primarily for mapping?
(A) Sound energy
(B) Nuclear energy
(C) Electromagnetic energy
(D) Thermal energy only

84. The scale of a map is 1:50000. A length of 3 cm on map represents a ground distance of
(A) 150 m
(B) 1500 m
(C) 15000 m
(D) 15 km

85. GIS stands for
    (A) Ground Identification System
    (B) Geographic Information System
    (C) General Instrumentation System
    (D) Geodetic Information Software

86. The California Bearing Ratio (CBR) test is used to determine the
    (A) Compressive strength of soil
    (B) Bearing capacity of sub-grade
    (C) Shear strength of pavement
    (D) Permeability of sub-base

87. The camber provided on roads is primarily to
    (A) Prevent skidding
    (B) Drain off rainwater
    (C) Provide comfort
    (D) Reduce speed

88. The maximum gradient recommended on a national highway in plain terrain is
    (A) 3%
    (B) 5%
    (C) 7%
    (D) 10%

89. Sight distance is primarily provided for
    (A) Safety against collision
    (B) Aesthetic appearance
    (C) Reducing speed
    (D) Improving drainage

90. The superelevation on roads is provided to counteract the effect of
    (A) Gravity
    (B) Centrifugal force
    (C) Wind force
    (D) Braking force

91. The Marshall method of mix design is used for
    (A) Cement concrete pavements
    (B) Bituminous pavements
    (C) WBM pavements
    (D) Gravel roads

92. The PCU (Passenger Car Unit) for a bicycle is
    (A) 0.5
    (B) 1.0
    (C) 0.25
    (D) 2.0

93. The traffic signal cycle length is computed using
    (A) Webster's formula

(B) Wardrop's principle
(C) Greenshields model
(D) Highway Capacity Manual

94. The modulus of subgrade reaction (k) is used in the design of
(A) Flexible pavements
(B) Rigid pavements
(C) Both A and B
(D) Sub-base only

95. The minimum clearance height for underpasses on national highways in India is
(A) 4.0 m
(B) 4.5 m
(C) 5.0 m
(D) 5.5 m

96. The free mean speed is the speed observed when
(A) Traffic density is very high
(B) Traffic density is very low
(C) Traffic is at capacity
(D) Traffic flow is uniform

97. Reconnaissance survey for road alignment is done at a scale of
(A) 1:250
(B) 1:500
(C) 1:50000
(D) 1:10000

98. The shape of speed-flow curve shows that maximum flow occurs at
(A) Maximum speed
(B) Minimum speed
(C) Intermediate speed (optimum)
(D) Zero speed

99. The grade compensation at curves in roads is provided to
(A) Increase visibility
(B) Account for extra resistance on curves
(C) Increase speed
(D) Prevent erosion

100. The most critical load position for design of a rigid pavement is
(A) At mid-span
(B) At the interior of slab
(C) At the edge of slab
(D) At the corner of slab

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