21105 **90 MINUTES**

1. Lifting hook system for a concrete pole of length 4m has to be designed. Ideal positions for hooks in the pole for minimum bending moment distribution is
   A) One hook at the centre of pole
   B) Two hooks 0.1m from ends
   C) Two hooks 0.75m from ends
   D) Two hooks 1.17 m from centre

2. Dirac delta function can be used for representing load in the form of
   A) Concentrated load B) Concentrated moment
   C) Uniformly distributed load D) Uniformly varying load

3. A simply supported beam of span L is subjected to two point loads W at quarter span points. The variation of bending moment $\frac{dM}{dx}$ in between the loading points
   A) WL/4 B) 0
   C) Parabolic D) WL/8

4. The static indeterminacy of a square truss with two diagonal members and hinged supports is
   A) Internally indeterminate to 1
   B) Externally indeterminate to 1
   C) Degree of static indeterminacy is 2
   D) All the above

5. Radius of Mohr circle for strain analysis is
   A) $\frac{\sigma_1 - \sigma_2}{2}$ B) $\frac{\varepsilon_x - \varepsilon_y}{2}$
   C) $\frac{\gamma_{max}}{2}$ D) None of these

6. A column of length L is clamped at both ends and held in position. The Euler crippling load is
   A) $\frac{\pi^2 EI}{L^2}$ B) $\frac{4\pi^2 EI}{L^2}$
   C) $\frac{2\pi^2 EI}{L^2}$ D) $\frac{\pi^2 EI}{4L^2}$

7. A three hinged parabolic arch of span L and rise R is subjected to uniformly distributed load w. The horizontal reaction at the supports is
   A) $\frac{wL^2}{8R}$ B) $\frac{wL^2}{8}$
   C) $\frac{wL}{2}$ D) 0

8. In a eccentrically loaded column of size 300mm square, the kernel is
   A) Rhombus with half diagonal 50mm
   B) Square with half diagonal 25mm
   C) Circle of radius 50mm
   D) None of these

9. The ratio of deflection in the mid span of a fixed beam and simply supported beam of same spans and subjected to uniformly distributed load is
   A) 5 B) 16
   C) 1/16 D) 1/5

10. A cantilever beam of span L is loaded with UDL over half span near fixed support. The slope at the free end of the beam is
   A) $\frac{wL^3}{3EI}$ B) $\frac{wL^3}{24EI}$
   C) $\frac{wL^3}{48EI}$ D) None of these

11. Muller Breslau principle is used for calculating BMs, SFs and Reaction
   A) ILD ordinates of determinate beams only
   B) ILD ordinates of indeterminate beams only
   C) ILD for both determinate and indeterminate beams
   D) All the above

12. The kinematic indeterminacy of a two storeyed two bay plane frame with fixed base is
   A) 18 B) 0 C) 24 D) 9

13. Strain energy in torsion in a prismatic member is
   A) $\int \frac{P^2}{2AE} dx$ B) $\int \frac{M^2}{2EI} dx$ C) $\frac{\tau^2}{4G} V$ D) $\int \frac{\tau^2}{4G} dx$

14. Virtual work is the work done by a
   A) Real force over virtual displacement
   B) Virtual force over virtual displacement
   C) Real force over real displacement
   D) None of these

15. A portal frame is with equal legs and span length and fixed base. The plastic moment for one column is Mp and for other column and beam is 2Mp. Collapse load from sway mechanism is
   A) $\frac{4M_p}{L}$ B) $\frac{6M_p}{L}$ C) $\frac{8M_p}{L}$ D) $\frac{7M_p}{L}$

16. The carry over factor for a prismatic member with far end hinged condition is
   A) Half B) 0 C) 1 D) 2

17. The stiffness influence coefficient for a beam element corresponding to degree of freedom in the axial translation direction is

A) $\frac{AE}{L}, \frac{-AE}{L}$ B) $\frac{4EI}{L}, \frac{2EI}{L}$

C) $\frac{GJ}{L}, \frac{-GJ}{L}$ D) None of the above

18. A thin cylindrical shell of thickness 10mm and diameter 1m is subjected to internal pressure 1kN/m^2. Assume E 2.5×10^5MPa and υ 0.25, longitudinal strain in the shell is

A) 0.02 micro strain B) 0.01 micro strain

C) 0.05 micro strain D) 0.03 micro strain

19. Minimum grade of concrete for a liquid retaining structure with capacity 75m^3 is

A) M20 B) M30 C) M35 D) M40

20. Limiting neutral axis depth of a rectangular beam of 300mm×440mm reinforced with 20mm diameter bars Fe500 grade with clear cover 30mm is

A) 300mm B) 400mm C) 220mm D) 184mm

21. Target mean strength of M30 grade concrete with tolerance factor 2 and standard deviation 6 is

A) 42MPa B) 30MPa

C) 38MPa D) None of the above

22. Limiting the deflection including the effects of temperature, creep and shrinkage occurring after erection of partitions and the application of finishes should not exceed

A) Span/250 or 20mm which ever is less

B) 20mm

C) Span/350 or 20mm which ever is less

D) Span/250

23. The compression development length of 20mm diameter bar for a design bond strength 1.5MPa and Fe250 grade steel stressed to 150MPa is

A) 500mm B) 400mm C) 350mm D) 250mm

24. Expansion joints in RCC structures must be provided, if the length of structure is more than

A) Width B) 25m C) 30mm D) 45m

25. The critical section for shear in a slab for a column- slab junction is at a distance equal to

A) Effective depth of slab from face of column

B) Half effective depth of slab from face of column

C) Column width in front

D) None of these

26. The percentage loss of prestress in a pretensioned rectangular beam due to shrinkage of concrete (for initial prestress 600MPa, Es 2×10^5MPa and shrinkage strain 300 micro strain) is
A) 10% B) 5% C) 15% D) 12%

27. Cross section in which the extreme fiber in compression can reach yield stress but can not develop the plastic moment of resistance due to local buckling is called
A) Plasic B) Compact C) Semi compact D) Slender

28. Limiting slenderness ratio of a member always acting as a non pretensioned tension member is
A) 250 B) 300 C) 350 D) 400

29. The partial safety factor for accompanying live load in DL+LL+CL combination for limit state of strength is
A) 1.5 B) 1.05 C) 1 D) 0.53

30. Design strength of a tension member is calculated using criteria
A) Yielding of cross section B) Net section rupture
C) Block shear D) All the above

31. Drift is the soil transported by
A) Wind B) Water
C) Glacier D) Gravitational force

32. The ratio of volume of voids to volume of soil solids in a given soil mass is known as
A) Void ratio B) Porosity
C) Specific gravity D) Percentage air voids

33. The minimum water content at which soil just begins to crumble when rolled into a thread of 3mm diameter is known as
A) Liquid limit B) Plastic limit
C) Shrinkage Limit D) Plasticity index

34. The neutral stress in a soil mass is
A) Force per neutral area B) Force per effective area
C) Stress taken up by pore water D) Stress taken up by solid particles

35. In sedimentation analysis the principle used is
A) Newton's Law B) Darcy's Law
C) Rebhan's Law D) Stoke's Law

36. Honey combed structure is found in
A) Gravels B) Coarse sands
C) Silts D) Clays

37. A clay deposit subjected to pressure in the past which is more than the present overburden pressure is called as
A) Normally consolidated clay B) Over consolidated clay
C) Under consolidated clay D) None of these

38. In a Standard Proctor Compaction test the weight of the rammer is
A) 3 Kg B) 2 Kg C) 2.5 Kg D) 3.5 Kg

39. Vibratory compactors are suitable for compacting
A) Granular soils B) Cohesive soils
C) Viscous soils D) Rocks

40. Deviator stress is
A) $\sigma_1 + \sigma_3$ B) $\sigma_1 - \sigma_3$ C) $\sigma_3 + \sigma_2$ D) $\sigma_2 - \sigma_3$

41. A shear test in which drainage is permitted during the application of normal stress and drainage not permitted during the application of shear stress is called
A) Unconsolidated Undrained B) Consolidated Drained
C) Consolidated Undrained D) Slow test

42. The depth of exploration for isolated spread footings is equal to
A) One and a half times the width of foundation
B) Two times the width of foundation
C) Width of foundation
D) Half the width of foundation

43. The free fall of hammer in a Standard penetration test is equal to
A) 65 cm B) 70 cm C) 75 cm D) 85 cm

44. In Standard Penetration test, N- value is
A) Number of blows for the first 15 cm penetration
B) Number of blows for the first 30 cm penetration
C) Number of blows for 30 cm penetration after the first 15cm penetration
D) Number of blows for 30 cm penetration after the first 30cm penetration

45. At shrinkage limit, the soil is
A) Dry B) Partially saturated
C) Fully saturated D) None of these

46. The condition at which every point in a soil mass is on the verge of failure is called
A) Plastic Equilibrium B) Elastic Equilibrium
C) Failure Equilibrium D) Yielding Equilibrium

47. The centre of critical slip circle in a slope is located by
A) Coulomb's method B) Culmann's graphical method
C) Fellinious directional angles D) Rebhann's graphical method

48. General shear failure occurs when the angle of shearing resistance is
A) Greater than 36^0 B) Smaller than 25^0
C) Greater than 30^0 D) Greater than 15^0

49. If the independent spread footings of two columns are connected by a beam, the foundation is called
A) Combined footing B) Connected footing
C) Joined footings D) Strap footing

50. In Engineering News formula the value of constant C for a drop hammer is
A) 1.5 B) 2.5 C) 0.25 D) 2.25

51. Indirect ranging is adopted when the two ends of the chain line are
A) Very near to each other B) Not intervisible
C) Intervisible D) None of the above

52. The bearing of a line measured either from magnetic north or south towards west or east is called
A) Reduced bearing B) Back bearing
C) Whole circle Bearing D) Fore bearing

53. The horizontal angle between the true meridian and the magnetic meridian through a station is called
A) Reduced bearing B) Magnetic declination
C) Fore bearing D) Whole circle bearing

54. Alidade is used in plane table surveying to
A) Check horizontality of table B) Measure angles
C) Sight objects D) Measure distances

55. When the plane table is so placed with respect to its vertical axis that all the lines on the paper remain parallel to the corresponding lines on the ground, the plane table is said to be
A) Levelled B) Corrected
C) Oriented D) Adjusted

56. In a metric chain tallies are provided at every
A) Metre length B) 5 m length
C) 10 m length D) 7 m length

57. A surface perpendicular to the direction of gravity at all points is called
A) Level surface B) Horizontal surface
C) Plain surface D) Datum surface

58. Temporary adjustments of a dumpy level are to be done
A) During manufacture
B) At the time of purchase
C) At each setup of the instrument
D) During first use only

59. The condition in which the image formed by the object glass is not in the plane of the cross hairs is called
A) Focussing error B) Collimation error
C) Refraction error D) Parallax

60. The last staff reading taken after setting up the instrument at a station is called
A) Fore sight B) Last sight
C) Back sight D) Intermediate sight

61. A theodolite is used to measure
A) Bearing of a line B) Declination
C) Elevation D) Horizontal and vertical angles

62. Trunnion axis in a theodolite is
A) Vertical axis B) Horizontal axis
C) Line of sight D) Axis of bubble tube

63. A curve consisting of two or more simple arcs that turn in the same direction and join at common tangent point is called
A) Simple curve B) Combined Curve
C) Reverse curve D) Compound curve

64. Tangent distance in a curve is
A) Distance between point of curve and point of intersection
B) Distance between point of curve and point of tangency
C) Distance between centre of curve and point of intersection
D) Distance between centre of curve and point of tangency

65. Point of compound curvature is
A) Point of maximum curvature in a compound curve
B) Point of minimum curvature in a compound curve
C) Meeting point of the two simple arcs forming the compound curve
D) Intersection point of the tangents in a compound curve

66. In a reverse curve, point of reverse curvature is
A) Starting point of the first simple curve
B) End point of the second simple curve
C) Common tangent point of the two simple curves
D) Centre point of the first curve

67. A curve of varying radius introduced between a straight line and a circular curve is
A) Easement curve B) Compound curve
C) Varying curve D) Widening curve

68. Errors which remain after all other errors have been eliminated and are caused by a combination of reasons beyond the ability of the surveyor to control are called as
A) Mistakes B) Systematic errors
C) Accidental errors D) Minor errors

69. The difference between the most probable value of a quantity and its observed value is
A) Most probable error B) Residual error
C) True error D) Accidental error

70. An equation expressing the relation existing between several dependent quantities is
A) Conditioned equation B) Normal equation
C) Observation equation D) Empirical equation

71. The maximum value of super elevation in plain and rolling terrain is
A) 7% B) 10% C) 19% D) 8%

72. The primary aim of providing camber is
A) Better appearance B) Easy drainage
C) Separation of to and fro traffic D) Road safety

73. The width of shoulder commonly adopted for two lane roads in India is
A) 1.5 m B) 1.2 m C) 2.5 m D) 3 m

74. As per revised IRC guidelines (IRC 37 – 2001) a flexible pavement has been designed as a
A) Double layered structure B) Three layered structure
C) Four layered structure D) Five layered structure

75. In Burmister's analysis the pavement is considered as a
A) Single layered system B) Double layered system
C) Three layered system D) Four layered system

76. The temperature at which bitumen gives off vapours which ignite in the presence of a flame but do not continue to burn is
A) Fire point B) Flash point
C) Ignition point D) Unstable point

77. Break point of bitumen is the temperature at which
A) Melting starts B) Vapourising starts
C) Boiling starts D) Cracking occurs

78. Bengleman beam measures
A) Deflections under standard wheel loads
B) Stresses under standard wheel loads
C) Crack width under standard wheel loads
D) Bending moment under standard wheel loads

79. The rating system for pavements, developed from AASHTO road test, based on measurement of permanent deformation, riding quality, extend of cracking, patching etc. is
A) Road safety index B) Pavement viability number
C) Present serviceability index D) Pavement strength index

80. As per IRC, the shape of warning sign is
A) Round shape
B) Square shape
C) Diamond shape
D) Equilateral triangle with one point upward

81. The pressure in metres of oil (specific gravity 0.8) equivalent to 80 m of water is
A) 64 B) 80 C) 100 D) 88

82. If stream function $\Psi = 2xy$, then the velocity at a point (1,2) is equal to
A) 2 B) 4 C) $\sqrt{20}$ D) 16

83. The drag on a very small sphere falling in a highly viscous fluid varies
A) Inversely with the velocity
B) Directly with the velocity
C) As the square root of the velocity
D) As the square of the velocity

84. The discharge scale ratio for Froude model law is
A) $L_r^{0.5}$ B) L_r^2 C) $L_r^{2.5}$ D) L_r^3

85. The specific speed of a turbine, having speed N, power P and head H, is given by
A) $(N\sqrt{P})/H^{3/2}$ B) $(N\sqrt{P})/H^{5/4}$
C) $(N\sqrt{P})/H^{3/4}$ D) $(N\sqrt{P})/H^{5/2}$

86. The flow mass curve is an integral curve of
A) Hydrograph B) Hyetograph
C) Flow duration curve D) S-curve

87. For the irrigation of crop, the base period B in days, duty D in ha/(m^3/s) and Δ in metres are related as
A) $D=(0.864B)/\Delta$ B) $\Delta=(8.64D)/B$
C) $D=(0.864\Delta)/B$ D) $\Delta=(8.64B)/D$

88. The volume of water that can be extracted by force of gravity from a unit volume of aquifer material is known as
A) Safe yield B) Specific yield
C) Specific retention D) Specific storage

89. Match the following correctly

(a) Khosla's curves	(i) infiltration capacity
(b) L. K. Sherman's theory	(ii) flood routing
(c) Horton's method	(iii) unit hydrograph
(d) Muskingum method	(iv) weirs and barrages

A) (a)-(iv) (b)-(iii) (c)-(i) (d)-(ii) B) (a)-(i) (b)-(iv) (c)-(ii) (d)-(iii)
C) (a)-(iv) (b)-(i) (c)-(ii) (d)-(iii) D) (a)-(ii) (b)-(iii) (c)-(iv) (d)-(i)

90. A geologic formation which is essentially impermeable for flow of water even though it may contain water in its pores, is called
A) Aquifer B) Aquifuge
C) Aquitard D) Aquiclude

91. The surface loading or overflow rate of a sedimentation tank passing a discharge Q and having length L, depth D, width B is given by
A) Q/(BD) B) Q/(BL) C) QBD D) Q/(BDL)

92. The maximum permissible limit of fluoride in drinking water should not exceed
A) 0.5 ppm B) 1.5 ppm C) 5 ppm D) 10 ppm

93. If the depletion of oxygen is found to be 2 mg/l after incubating 3 ml of sewage diluted to 300 ml, at 20^{o}C for 5 days, then the BOD_5 of the sewage would be
A) 200 mg/l B) 300 mg/l
C) 500 mg/l D) 600 mg/l

94. The sewage treatment unit which works on anaerobic decomposition of organic matter is
A) Septic tank B) Oxidation pond
C) Activated sludge plant D) Trickling filter

95. A polluted stream undergoes self purification in four distinct zones
(i) zone of cleaner water (ii) zone of active decomposition
(iii) zone of degradation (iv) zone of recovery

The correct sequence of these zones is
A) (iii),(iv),(ii),(i) B) (ii),(iii),(iv),(i)
C) (ii),(iv),(iii),(i) D) (iii),(ii),(iv),(i)

96. Imhoff cone is used to measure
A) Total solids B) Total organic solids
C) Total inorganic solids D) Settleable solids

97. Which of the following air pollutants is/are responsible for photochemical smog?
(i) oxides of nitrogen(ii) ozone (iii) unburnt hydrocarbons (iv) carbon monoxide
A) (i) alone B) (ii), (iii) and (iv)
C) (i) and (iii) D) (i), (iii) and (iv)

98. Which among the following is not a primary air pollutant?
A) Oxides of nitrogen
B) Volatile organic compounds like hydrocarbons
C) Suspended particulate matter
D) Peroxy Acetyl Nitrate

99. The liquid that has percolated through the solid waste, and has extracted dissolved or suspended materials from it, is called
A) Sewage B) Leachate
C) Compost D) Particulate

100. Noise is measured in terms of
A) Hertz (Hz) B) Decibel (dB)
C) Doboson unit (DU) D) None of these