10/26

Question Booklet Alpha Code

A

Question Booklet Sl. No.

A

Total Number of Questions : 100 **Time : 90 Minutes**

Maximum Marks : 100

INSTRUCTIONS TO CANDIDATES

1. The Question Paper will be given in the form of a Question Booklet. There will be four versions of Question Booklets with Question Booklet Alpha Code viz. **A, B, C** & **D**.
2. The Question Booklet Alpha Code will be printed on the top left margin of the facing sheet of the Question Booklet.
3. The Question Booklet Alpha Code allotted to you will be noted in your seating position in the Examination Hall.
4. If you get a Question Booklet where the alpha code does not match to the allotted alpha code in the seating position, please draw the attention of the Invigilator IMMEDIATELY.
5. The Question Booklet Serial Number is printed on the top right margin of the facing sheet. If your Question Booklet is un-numbered, please get it replaced by new Question Booklet with same alpha code.
6. The Question Booklet will be sealed at the middle of the right margin. Candidate should not open the Question Booklet, until the indication is given to start answering.
7. Immediately after the commencement of the examination, the candidate should check that the Question Booklet supplied to him/her contains all the 100 questions in serial order. The Question Booklet does not have unprinted or torn or missing pages and if so he/she should bring it to the notice of the Invigilator and get it replaced by a complete booklet with same alpha code. This is most important.
8. A blank sheet of paper is attached to the Question Booklet. This may be used for rough work.
9. **Please read carefully all the instructions on the reverse of the Answer Sheet before marking your answers.**
10. Each question is provided with four choices **(A), (B), (C)** and **(D)** having one correct answer. Choose the correct answer and darken the bubble corresponding to the question number using Blue or Black Ball Point Pen in the OMR Answer Sheet.
11. **Each correct answer carries 1 mark and for each wrong answer 1/3 mark will be deducted. No negative mark for unattended questions.**
12. No candidate will be allowed to leave the examination hall till the end of the session and without handing over his/her Answer Sheet to the Invigilator. Candidates should ensure that the Invigilator has verified all the entries in the Register Number Coding Sheet and that the Invigilator has affixed his/her signature in the space provided.
13. Strict compliance of instructions is essential. Any malpractice or attempt to commit any kind of malpractice in the Examination will result in the disqualification of the candidate.

A

1. The range of deformation where the material undergoes irreversible dimensional change is generally known as
   A) Elastic B) Plastic C) Creep D) Fatigue

2. The intersection of the plane of the neutral layer with the cross section of the beam is called
   A) Neutral axis B) Point of contraflexure
   C) Influence line D) Elastic curve

3. The ratio of Shear modulus to Young's modulus for a material with Poisson's ratio of 0.25 is
   A) 2 B) 0.2 C) 4 D) 0.4

4. A composite bar consists of two bars of cross sectional area and Young's modulus of A_1, E_1 and A_2, E_2 respectively. Compatibility condition requires the stresses in the bars σ_1 and σ_2 to be related as
   A) $\sigma_1 = \sigma_2$ B) $\sigma_1 A_1 + \sigma_2 A_2 = 0$
   C) $\sigma_1 / \sigma_2 = E_1 / E_2$ D) $\sigma_1 E_1 = \sigma_2 E_2$

5. The failure of a material below the yield point, when subjected to repeated stresses is known as
   A) Fatigue B) Collapse C) Resilience D) Rupture

6. Introduction of an internal hinge in a simply supported beam makes it
   A) Statically determinate B) Statically indeterminate
   C) Stable D) Unstable

7. A truss is analysed assuming that
   A) The loads are applied along the axes of members only
   B) The loads are applied at the joints only
   C) Rotation of joints is not allowed
   D) The members undergo flexural deformation

8. A funicular arch resists
   A) Flexure only B) Both flexure and shear
   C) Compression only D) Both compression and shear

9. Kinematic indeterminacy at the fixed support of a plane frame is
   A) 6 B) 3 C) 2 D) 0

10. The strain energy stored in a member of length L and axial rigidity AE subjected to a gradually applied axial force P is

A) $\frac{PL}{2AE}$ B) $\frac{PL^2}{2AE}$ C) $\frac{P^2L}{2AE}$ D) $\frac{PL^3}{3AE}$

11. The pressure head, in meters of mercury, equivalent to the pressure head of 272 m of water is

A) 20 B) 200 C) 13.6 D) 1

12. A wooden rectangular block of length 1 m is made to float in water with its axis vertical. If the centre of gravity of the floating body is 0.2 m above the centre of buoyancy, find the specific gravity of the wooden block.

A) 0.65 B) 0.6 C) 0.7 D) 0.75

13. For a uniform flow in a rectangular channel, the depth of flow is 1 m and Froude number is 2.0. Find the specific energy.

A) 3 m B) 0.33 m C) 1 m D) 2 m

14. A turbine develops 425 kW power under a net head of 20 m. If the overall efficiency of the turbine is 85%, the discharge of water having specific weight 10 kN/m^3 through the turbine in m^3/s, is

A) 5 B) 25 C) 2.5 D) 2

15. In the Froude law of similitude, the time scale ratio in terms of length scale ratio L_r is

A) L_r^2 B) L_r C) $L_r^{1.5}$ D) $L_r^{0.5}$

16. The rainfall on five successive days on a catchment was 3 cm, 6 cm, 9 cm, 5 cm and 4 cm respectively. If the ϕ-index for the storm can be assumed to be 4 cm/day, the total direct runoff from the catchment is

A) 10 cm B) 8 cm C) 9 cm D) 20 cm

17. A direct runoff hydrograph due to an isolated storm is triangular in shape with base of 100 h and peak of 50 m^3/s. If the catchment area is 150 km^2, the rainfall excess in the storm is

A) 4 cm B) 5 cm C) 6 cm D) 8 cm

18. If a crop requires a total depth of 0.5 m of water for a base period of 100 days, then the duty in hectares/cumecs is about

A) 864 B) 1728 C) 100 D) 432

19. The meander ratio is the ratio of
    A) The curved length of the river to the meander length
    B) Main curved channel length to the width of the meander belt
    C) The length of the meandering river to the number of loops in a stretch
    D) The width of the meander belt to the meander length

20. For a well penetrating an unconfined aquifer having permeability 4×10^{-4} m/s, the radius of influence for a drawdown of 4 m is approximately
    A) 240 m B) 300 m C) 200 m D) 400 m

21. A series of closely spaced contour lines represents a
    A) Uniform slope B) Plane surface
    C) Steep slope D) Gentle slope

22. If the horizontal distance between the staff point and the point of observation is 'd', then the error due to curvature of earth is proportional to
    A) d^2 B) $\frac{1}{d^2}$ C) d D) $\frac{1}{d}$

23. In GPS, elevation or vertical height is measured with reference to the
    A) Geoid B) Mean sea level of the country
    C) Global mean sea level D) Ellipsoid

24. For a total station survey, prism/reflector is essential to measure
    A) Horizontal distances B) Vertical angles
    C) Horizontal angles D) Both angles and distances

25. In GIS, a continuously varying phenomenon like temperature, ground water levels, etc. can be easily represented in
    A) Vector format B) Raster format
    C) Polygons and polylines format D) Multiple point data format

26. The reduced level of point A which is on the floor is 100.000 m and the backsight reading on A is 2.455 m. If the foresight reading on point B which is on the ceiling is 2.745 m, the reduced level of point B will be
    A) 94.800 m B) 99.710 m
    C) 100.290 m D) 105. 200 m

27. The original cost of an equipment is Rs. 10,000/-. Its salvage value at the end of its total useful life of 5 years is Rs. 1,000/-. Its book value at the end of 2 years of its useful life (as per straight line method of evaluation of depreciation) will be
    A) Rs. 8,000/- B) Rs. 6,000/- C) Rs. 6,400/- D) Rs. 8,200/-

28. What is the capitalised value of a property fetching a net annual rent of Rs. 1,000/- and the rate of interest is 8% ?
    A) Rs. 18,500/- B) Rs. 16,500/- C) Rs. 14,500/- D) Rs. 12,500/-

29. The measurement of D.P.C. (Damp Proof Course) is made in
    A) Meters B) Square meters
    C) Cubic meters D) Decimeters

30. In long and short wall method of estimation, the length of long wall is the centre to centre distance between the walls and
    A) Breadth of the wall B) One fourth breadth of wall on each side
    C) Half breadth of wall on each side D) None of the above

31. For different concrete specimens, each hydrated to the same degree, the permeability is
    A) Higher with lower water cement ratio and higher cement content
    B) Lower with lower water cement ratio and higher cement content
    C) Lower with higher water cement ratio and lower cement content
    D) Lower with higher water cement ratio and higher cement content

32. Tensile strength of concrete is measured by
    A) Direct tension test in the universal testing machine
    B) Applying compressive load along the length of the cylinder
    C) Applying third point loading along a prism
    D) Applying tensile load along the length of the cylinder

33. The most common admixture which commonly accelerate the setting of cement is
    A) Gypsum B) Calcium carbonate
    C) Calcium chloride D) Superplasticiser

34. In a concrete mix, if the maximum size of coarse aggregate is increased, the proportion of fine to coarse aggregate should be
    A) Decreased B) Increased
    C) Kept the same D) Not dependent on size of aggregate

35. After making 1 : 2 : 4 concrete by volume batching, it was noticed that the sand used was wet with 25% bulking. Hence the true mix proportion of this concrete will be

A) 1 : 1.75 : 4 B) 1 : 2.25 : 4

C) 1 : 2.50 : 4 D) 1 : 1.60 : 4

36. Soundness test of cement is done to determine its

A) Durability in sea water B) Iron oxide content

C) Free-lime content D) Alumina content

37. A window which projects outside the room of a building is known as

A) Dormer window B) Bay window

C) Lantern window D) Casement window

38. The foundation in which a cantilever beam is provided to join two footings is known as

A) Strap footing B) Strip footing

C) Combined footing D) Raft footing

39. The type of pile which is driven at an inclination to resist inclined forces is known as

A) Friction pile B) Sheet pile C) Batter pile D) Anchor pile

40. The line of intersection of the surfaces of a sloping roof, forming an external angle exceeding 180° is

A) Ridge B) Hip C) Valley D) None of the above

41. Exposed portions of vertical surface at right angles to the door or window frame are known as

A) Jambs B) Lintels C) Soffits D) Reveals

42. Preferred arrangement for more than 3 lifts at the same location is

A) Parallel arrangement

B) Criss-cross arrangement

C) Alcove arrangement

D) Straight line arrangement

43. Type of elevators suitable to serve low rises and heavy capacity are

A) Traction elevators B) Hydraulic elevators

C) Dumbwaiters D) Goods elevators

44. ABC analysis is

A) For choosing proper suppliers

B) Used for stock taking

C) Basic tool for establishing economic stock levels

D) Used for obtaining the lead time

45. If the pessimistic time, optimistic time and most likely time for an activity are 13, 8 and 9 days respectively, its expected time and variance are respectively

A) 9.5 and $\frac{25}{36}$

B) 9.5 and $\frac{5}{6}$

C) 8.5 and $\frac{25}{36}$

D) 8.5 and $\frac{5}{6}$

46. A project is expected to take 24 months along the critical path having a standard deviation of 3.6 months. What is the probability of completion of the project within 24 months ?

Given

z	0	0.60	1.60	1.80
Probability P(z)	50.0	72.6	94.5	96.4

A) 50.0%

B) 72.6%

C) 94.5%

D) 96.4%

47. There are four consecutive activities in a linear network, each with mean duration of 'T' and each with 'K' as the standard deviation of its duration. The overall project duration is likely to be in the range

A) $4T \pm K$

B) $4T \pm 2K$

C) $4T \pm 4K$

D) $4T \pm 6K$

48. Free float is determined to

A) Identify the activities which can be delayed without affecting the total float of succeeding activity

B) Identify the activities which can be delayed without affecting the total float of preceding activity

C) Identify the activities which can be delayed without affecting the total float of both preceding as well as succeeding activities

D) Establish the priorities

49. Whenever an activity has zero total float, then
    A) Its free float is also zero, but its independent float need not be zero
    B) Its independent float is also zero, but its free float need not be zero
    C) Both free float and independent float need not be zero
    D) Both free float and independent float are zero

50. If 't' is the possible duration of an activity, 'T_1' is the latest finish possible moment of its preceding activity and 'T_2' is the earliest start possible moment of its succeeding activity, the independent float of the activity is
    A) $(T_2 - T_1) - t$
    B) $t - (T_2 - T_1)$
    C) $(T_2 + T_1) - t$
    D) $t + (T_2 + T_1)$

51. High test hypochlorites contains how much percentage of available chlorine ?
    A) 90% B) 35% C) 70% D) 85%

52. As per BIS, the minimum per capita domestic consumption for rural communities with population upto 20,000 where piped water supply service connection is proposed is
    A) Not less than 70 – 100 l/c/d
    B) Not less than 40 l/c/d
    C) Not less than 135 – 225 l/c/d
    D) Not less than 100 – 135 l/c/d

53. ARHP means
    A) Average life of Rural Health People
    B) Average Rainfall Hourly Potential
    C) Annual Rainwater Harvesting Potential
    D) None of the above

54. Type of alkalinity which is present in water sources for pH of 8.3 is
    A) Carbonate B) Bicarbonate C) Hydroxide D) Total alkalinity

55. Odour of a water is determined at a temperature of
    A) 25 – 28°C B) 24 – 25°C C) 20 – 22°C D) 20°C

56. In India, where rain occurs for a few months, the preferred sewerage system would be
    A) Combined system
    B) Separate system
    C) Partially separate system
    D) None of these

57. In a pure or neutral water the quantum of H^+ and OH^- will each be equal to

A) 10^{-7} moles/litre B) 10^{-14} moles/litre

C) 7 moles/litre D) 14 moles/litre

58. The relative stability of a sewage sample, whose D.O. equals the total oxygen required to satisfy BOD, is

A) Zero B) 1% C) 100% D) Infinity

59. One Dobson Unit (DU) is equal to

A) 1 mm B) 0.1 mm C) 0.01 mm D) 0.001 mm

60. In a conventional activated sludge plant, the oxygen demand is highest near the

A) Inlet end of the aeration tank B) Outlet end of the aeration tank

C) Inlet end of the clarifier D) Outlet end of the clarifier

61. The final deflection limitation for floors and roofs due to all loads, including long term effect of temperature, creep and shortage

A) Span/350 B) Span/250 C) 20 mm D) Span/500

62. The minimum size of samples required for testing for 10 m^3 of concrete

A) 1 B) 2 C) 3 D) 4

63. The total compressive force at the time of failure of a concrete beam section of width 'b' without considering the partial safety factor of the material is

(where x_u is depth of neutral axis and f_{ck} is the characteristic compressive strength of concrete)

A) $0.36\ f_{ck}\ b\ x_u$ B) $0.54\ f_{ck}\ b\ x_u$

C) $0.66\ f_{ck}\ b\ x_u$ D) $0.80\ f_{ck}\ b\ x_u$

64. The modulus of rupture of concrete is the

A) Direct tensile strength of concrete

B) Direct compressive strength of concrete

C) Tensile strength of concrete under bending

D) Characteristic strength of concrete

65. The flexural strength of M25 grade concrete as per IS 456 : 2000

A) 25 MPa B) 18.40 MPa C) 3.5 MPa D) 31.6 MPa

66. The following two statements made for a simply supported under reinforced beam :
    1. Failure takes place by crushing of concrete before the steel has yielded.
    2. The neutral axis moves up as the load is increased.

    With reference to the above statements, which of the following applies ?

    A) Both the statements are true
    B) 1 is true, but 2 is false
    C) 1 is false, but 2 is true
    D) Both the statements are false

67. The minimum grade of concrete to be used as per IS 456 : 2000 for an RC structure constructed along sea coast

    A) M20 B) M25 C) M30 D) M35

68. As per IS 456 : 2000, the pH value of water for concrete mix shall not be less than

    A) 7.0 B) 6.50 C) 6 D) 5.50

69. The value of design bond stress in limit state method for plain bars in tension for M30 grade of concrete

    A) 1.2 MPa B) 1.4 MPa C) 1.5 MPa D) 1.7 MPa

70. The minimum area of tension reinforcement in a beam shall be greater than

    A) 0.85 bd/fy B) 0.87 bd/fy C) 0.85 fy/bd D) 0.04 bD

71. The minimum thickness of edge of an RCC footing on soils shall not be less than

    A) 150 mm B) 100 mm C) 200 mm D) 120 mm

72. Flexural cracks can be controlled by

    A) Longitudinal tension bars
    B) Appropriate shear reinforcement
    C) Longitudinal compression reinforcement
    D) None of the above

73. The maximum spacing of vertical stirrup measured along the axis of the members shall not exceed (where d denotes the effective depth)

    A) d or 300 mm whichever is less
    B) 0.75 d or 300 mm whichever is less
    C) 0.30 d
    D) 0.1 d

74. The partial safety factor for material resistance governed by ultimate stress is taken in IS 800 as

A) 1.15 B) 1.5 C) 1.25 D) 1.10

75. In property class 6.8 of bolts the number 6 and 8 indicates the ultimate stress of _____ and yield stress of _____ respectively.

A) 800 MPa/600 MPa B) 600 MPa/800 MPa

C) 600 MPa/480 MPa D) 800 MPa/480 MPa

76. Which is considered as the mode of failure of a fillet weld ?

A) Shear B) Tension

C) Bearing D) Bending

77. The effective length of fillet weld may be taken as

A) Total length – 2 × throat size

B) Total length – 2 × weld size

C) 0.9 times the total length

D) Total length – $\sqrt{2}$ × weld size

78. The spacing of counterforts in a retaining wall of moderate height

A) 3m

B) One third to two third of the total wall height

C) One third to one half of total height

D) One third the projecting height from ground level

79. In the case of footings, the critical section for one-way shear is taken at a distance of _____ from the face of the column.

A) Effective depth

B) Effective depth/2

C) Effective depth/3

D) Effective depth/4

80. The theoretical value of effective length of a column effectively held in position and restrained against rotation in one end and restrained against rotation but not held in position at the other end is

A) 1.0 L B) 2 L C) 0.5 L D) 0.7 L

81. What is the per capita demand, if Q is the total quantity of water a town requires per year in litres and the population in the city is P ?

A) $\frac{P}{Q \times 365}$ litres/day

B) $\frac{Q}{P \times 270}$ litres/day

C) $\frac{Q}{P \times 365}$ litres/day

D) $\frac{P}{Q \times 270}$ litres/day

82. What is the detention time for a circular sedimentation tank ?

A) $\frac{d^2(0.011d + 0.785H)}{Q}$

B) $\frac{Q^2(0.01d + 0.785H)}{d}$

C) $\frac{d^2(0.01d + 0.780H)}{Q}$

D) $\frac{d^2(0.011d + 0.685H)}{Q}$

83. The rate of filtration in rapid gravity filters is

A) 100 to 200 litres per hour per sq. m of filter area

B) 3000 to 6000 litres per hour per sq. m of filter area

C) 500 to 1000 litres per hour per sq. m of filter area

D) 1000 to 3000 litres per hour per sq. m of filter area

84. A centrifugal pump is required to lift 3 m^3/s of water to a height of 4.7 metres. Assuming the total loss of head in the pipe as 0.3 metres, calculate the water horsepower of the pump.

A) 300 B) 200 C) 64.47 D) 75.76

85. Write the Manning's formula for designing sewers and drains.

A) $V = c\sqrt{rs}$

B) $c = \frac{157.6}{1.81 + \frac{K}{\sqrt{r}}}$

C) $V = 0.85\ C_H r^{0.63} s^{0.54}$

D) $V = \frac{1}{n} r^{2/3} s^{1/2}$

86. Calculate the population equivalent of a given city

i. The average sewage from the city is 80×10^6 l/day, and

ii. The average 5 day BOD is 200 mg/l. Assume the domestic sewage quantity to be 0.08 kg/person/day.

A) 2,00,000 B) 1,28,000

C) 2,56,000 D) 32,000

87. The organic loading rate value of conventional trickling filters varies between
    A) 200 to 800 kg of BOD_5 per ha-m
    B) 6000 to 18000 kg of BOD_5 per ha-m
    C) 900 to 2200 kg of BOD_5 per ha-m
    D) 3000 to 6000 kg of BOD_5 per ha-m

88. The conventional activated sludge plant has been modified to eliminate the primary sedimentation tank, and sludge digestion tank, in a process is called
    A) Oxidation pond
    B) Oxidation ditch
    C) Anaerobic contact process
    D) UASB reactor

89. The septic tank effluent is not disposed off in
    A) Biological filters
    B) Soil absorption system
    C) Upflow anaerobic filters
    D) Stabilisation ponds

90. Which type of plume occurs when an inversion layer occurs at a short distance above the top of the stack, and super adiabatic conditions prevail below the stack ?
    A) Trapping Plume
    B) Fumigating Plume
    C) Fanning Plume
    D) Lofting Plume

91. In the mechanistic-empirical design approach specified by IRC : 37 : 2018, the fatigue failure of the pavement is due to
    A) Vertical strain at the top of subgrade
    B) Vertical strain at the top of sub-base
    C) Horizontal tensile strain at the bottom of the bituminous layer
    D) Tensile strain near the surface close to the edge of the wheel

92. The primary objective of providing extra width on a horizontal curve is
    A) To increase the braking distance
    B) To improve the aesthetics of the road
    C) To counteract off-tracking and steering difficulties of vehicles
    D) To provide space for future road widening

93. The specific part of a signal cycle allocated to a traffic movement or combination of movements is called as
    A) Cycle time
    B) Green time
    C) Clearance time
    D) Phase

94. The effective gradient of a runway is defined as
    A) Maximum gradient between two points
    B) Difference in elevation between highest and lowest points divided by total runway length
    C) Average gradient
    D) Steepest slope of any section

95. The runway orientation is generally planned so that landings and takeoffs occur
    A) Perpendicular to the wind direction
    B) Against the wind direction
    C) Along the wind direction
    D) At a 45 degree angle to the wind direction

96. What is the correction to be applied to the basic runway length of 2000 m for an airport site with 600 m rise in elevation above mean sea level, as per ICAO ?
    A) 280 m increase
    B) 140 m increase
    C) 100 m decrease
    D) 100 m increase

97. In a time-space diagram, the slope of the trajectory of a vehicle equal to
    A) Headway of the vehicle
    B) Acceleration of the vehicle
    C) Speed of the vehicle
    D) Displacement of the vehicle

98. A 5 degree curve is situated in a broad gauge track with a ruling gradient of 1 in 200. The actual ruling gradient allowing grade compensation for curvature is equal to
    A) 0.5 B) 0.4 C) 0.3 D) 0.2

99. The term “urban sprawl” refers to
    A) The organized growth of a city center
    B) The disorganized spread of urban areas
    C) The process of gentrification
    D) The development of vertical structures

100. Which of the following is an example of a smart city component ?
    A) Mass displacement of population
    B) Rural land preservation
    C) Congestion in urban areas
    D) Intelligent transport systems

Space for Rough Work