TEST BOOKLET
CIVIL ENGINEERING
Paper-I

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. PLEASE NOTE THAT IT IS THE CANDIDATE'S RESPONSIBILITY TO ENCODE AND FILL IN THE ROLL NUMBER SUBJECT, SUBJECT CODE AND CENTRE CODE CAREFULLY AND WITHOUT ANY OMISSION OR DISCREPANCY AT THE APPROPRIATE PLACES IN THE OMR ANSWER SHEET. ANY OMISSION/DISCREPANCY WILL RENDER THE ANSWER SHEET LIABLE FOR REJECTION.

3. You have to enter your roll Number on the Test Booklet in the Box provided alongside. DO NOT write anything else on the Test Booklet.

4. This Test Booklet contains 100 items (questions). Each item comprises four responses (answers). You will select the response which you want to mark on the Answer 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. You have to mark your responses ONLY on the separate Answer Sheet provided. See directions in the Answer Sheet.

6. All items carry equal marks.

7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.

8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator only the Answer Sheet. You are permitted to take away with you the Test Booklet.

9. Sheets for rough work are appended in the Test Booklet at the end.

10. There is no penalty for wrong answers.

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO
1. Which of the following is not a natural defect in timber?
   (a) Knot
   (b) Twisted fibres
   (c) Burrs
   (d) Honey combing
2. Seasoning of timber results in
   1. Increase in strength
   2. Increase in durability
   3. Reduced resilience
   of these statements
   (a) 1, 2 and 3 are correct
   (b) 1 and 3 are correct
   (c) 1 and 2 are correct
   (d) 2 and 3 are correct
3. Timber can be made fire resistant by
   (a) Dipping and steeping process
   (b) Sir Abel's process
   (c) Charring
   (d) Hot and cold open tank treatment
4. The wood preservative “Creosote” is derived from
   (a) Wood or coal
   (b) Acidic cupric chromate
   (c) Chromated zinc chloride
   (d) Pentachlorophenol
5. Radial split in timber originating from Bark and narrowing towards Pith are known as
   (a) Heart shakes
   (b) Star shakes
   (c) Cup shakes
   (d) Knots
6. A good soil for making bricks should contain:
   1. About 30% alumina
   2. About 10% lime
   3. About 15% magnesia
   4. 5% of iron oxide
   of these statements
   (a) 1 and 2 are correct
   (b) 1 and 4 are correct
   (c) 1, 3 and 4 are correct
   (d) 2, 3 and 4 are correct
7. The function of silica in good brick earth is to:
   1. Imparts plasticity
   2. Prevent cracking
   3. Provide uniform shape
   4. Helps in fusion
   of these statements
   (a) 1 and 2 are correct
   (b) 2 and 3 are correct
   (c) 1, 3 and 4 are correct
   (d) 2, 3 and 4 are correct
8. As per Indian Standard classification if brick is designated as 10, 10 stands for
   (a) Its compressive strength
   (b) Its tensile strength
   (c) Its length
   (d) Its cross sectional area

9. Standard modular size of common building bricks in millimeter (mm) shall be
   (a) 190 × 90 × 90
   (b) 115 × 90 × 90
   (c) 230 × 110 × 70
   (d) 230 × 110 × 30

10. The contribution of constituent of cement to the strength of cement is in the decreasing order
    (a) C₂S, C₃S, C₃A and C₄AF
    (b) C₃S, C₂S, C₃A and C₄AF
    (c) C₃S, C₂S, C₄AF and C₃A
    (d) None of the above

11. Low heat cement is used for
    (a) Repair of roads
    (b) Thin structure
    (c) None of the above
    (d) All of above

12. Aerated cement is produced by the addition of:
    1. Zinc sulphate
    2. Magnesium sulphate
    3. Powdered aluminium
    4. Sodium nitrate

    of these statements
    (a) 3 is correct
    (b) 1 and 3 are correct
    (c) 2 and 3 are correct
    (d) 1, 2 and 3 are correct

13. The specific surface of cement is determined by
    (a) Air permeability method
    (b) Autoclave method
    (c) Vicat apparatus
    (d) None of the above

14. Use of accelerators in concrete
    (a) Shorten the setting time
    (b) Increases period of curing
    (c) Decreases period of curing
    (d) Increase the setting time

15. Super plasticizer or high water reducing admixture
    (a) Increases workability
    (b) Decreases water requirement
    (c) Facilitate production of pumpable concrete
    (d) All the above

16. The ultrasonic test for hardened concrete of good quality is indicated if the pulse velocity is

(Contd.)
(a) Below 3.0 km/s  
(b) Between 3.0 to 3.5 km/s  
(c) Above 3.5 km/s  
(d) Above 4.5 km/s

17. The ratio of tensile strength of concrete to the compressive strength is
   (a) 1:33  
   (b) 1:25  
   (c) 1:10  
   (d) 1:05

18. If the Young’s modulus of elasticity of a material is twice its modulus of rigidity, then Poisson’s ratio of the material is
   (a) -1  
   (b) -0.5  
   (c) 0.5  
   (d) 0

19. What is the ratio of maximum shear stress to average shear stress in a rectangular section due to shear force V?
   (a) 1.125  
   (b) 1.333  
   (c) 1.500  
   (d) 2.666

20. Match the following
    Tests                Properties
    A Impact test        1 Ductility
    B Fatigue test       2 Toughness
    C Tension test       3 Endurance limit
    D Hardness test      4 Resistance to penetration
   (a) A-2, B-3, C-1, D-4  
   (b) A-1, B-2, C-3 D-4.  
   (c) A-2, B-3, C-4, D-1.  
   (d) A-4, B-3, C-2, D-1.

21. What is the ratio of Euler buckling load of a column with both ends fixed to the same column with one end fixed and other end free?
   (a) 16  
   (b) 8  
   (c) 4  
   (d) 2

22. What is the eccentricity of a compressive load on a solid circular section of diameter d for which stresses on whole section should be compressive?
   (a) $e \leq d/32$  
   (b) $e \leq d/16$  
   (c) $e \leq d/8$  
   (d) $e \leq d/4$

23. Variation of shear stress along the depth of a rectangular section due to constant shear force is
   (a) uniform  
   (b) linear  
   (c) parabolic  
   (d) cubic

(Contd.)
24. Distance of shear center from the center of web of channel is. (Where h, b, and t are the height, flange width, flange thickness of channel section respectively and I is the moment of inertia of channel section about horizontal neutral axis)

(a) $b^3h^2t/4l$
(b) $b^3h^3/4l$
(c) $b^3h^2/4l$
(d) $bh^3/4l$

25. If a simply supported beam is loaded with point load W at the centre then what is the ratio of bending moment at the support to the bending moment at the centre?

(a) 0.5
(b) 0
(c) 1
(d) 2

26. The power transmitted by hollow shaft will be more than that of solid shaft if their weight and density both are

(a) Equal
(b) Half
(c) One fourth
(d) None of the above

27. A bar 4 cm in diameter is subjected to an axial load of 4kN. The extension of the bar over a gauge length of 20 cm is 0.03 cm. The decrease in diameter is 0.0018 cm. The poisson’s ratio is

(a) 0.25
(b) 0.3
(c) 0.33
(d) 0.35

28. A compound bar consists of material A and B tightly secured at the ends. The coefficient of thermal expansion of A is more than that of B. When the temperature is increased the stresses induced will be

(a) tensile in both the material
(b) tensile in material A and compressive in material B
(c) Compressive in material A and tensile in material B
(d) compressive in both the material

29. A bar of square section is subjected to a pull of 10000 N. If the maximum allowable shear stress on any section is 50 MPa, then the side of the square section will be

(a) 5
(b) 10
(c) 15
(d) 20

30. A close coiled helical spring subjected to an axial load other quantities remaining the same, if the wire diameter is doubled, then the stiffness of the spring when compared to the original one will become

(a) Two times
(b) Four times

(Contd.)
31. For ductile materials, the most appropriate failure theory is
   (a) Maximum shear stress theory
   (b) Maximum principal stress theory
   (c) Maximum principal strain theory
   (d) Shear strain energy theory

32. Consider the following statements:
    The principle of superposition is applied to the
    1. Linear elastic bodies
    2. Bodies subjected to small deformation
    of these statements
   (a) 1 is correct
   (b) 1 and 2 are correct
   (c) 2 is correct
   (d) Neither 1 nor 2 is correct

33. A Mohr’s circle reduces to a point when the body is subjected to
   (a) Pure shear
   (b) Uniaxial stress only
   (c) Equal and opposite stresses on two mutually perpendicular planes, the planes being free of shear
   (d) Equal axial stress on two mutually perpendicular planes, the planes being free of shear

34. The maximum energy stored at elastic limit of a material is called
   (a) Resilience
   (b) Proof resilience
   (c) Modulus of resilience
   (d) Modulus of rigidity

35. In moment distribution method the sum of distribution factors of all the members meeting at any joint is always
   (a) Zero
   (b) Half
   (c) One
   (d) Two

36. The carryover factor in a prismatic member whose far end is hinged is
   (a) Zero
   (b) Half
   (c) Three fourth
   (d) One

37. The moment required to rotate the near end of a prismatic beam through unit angle, without translation, the far end being fixed, then the moment induced at the far end is, where EI is flexural rigidity and L is span of beam
   (a) EI/L
   (b) 2EI/L
   (c) 3EI/L
   (d) 4EI/L

(Contd.)
38. Castigliano's first theorem is applicable
(a) for statically determinate structures only
(b) when the system behaves elastically
(c) only when principle of superposition is valid
(d) all of the above

39. Bending moment at any section in a conjugate beam gives in the actual beam
(a) Slope
(b) Curvature
(c) Deflection
(d) Bending moment

40. If forces $P_1$, $P_2$, $P_3$ and $P_4$ of a system are such that the force polygon does not close, then the system will
(a) Be in equilibrium
(b) Reduce to resultant force
(c) Reduce to couple
(d) Not be in equilibrium

41. A three hinged symmetrical parabolic arch of span 20m and rise 5m carries a uniformly distributed load of 2KN/m for the whole span. The bending moment at the quarter point is
(a) 75 kN (hogging)
(b) 75 kN (sagging)
(c) 100 kN (hogging)
(d) Zero

42. Macaulay's method is used for calculation of
(a) bending moment
(b) shear force
(c) slope and deflection
(d) all the above

43. The kinematic indeterminancy of single bay portal frame fixed at the base is
(a) 1
(b) 2
(c) 3
(d) 4

44. A single bay portal frame of height $h$ fixed at the base is subjected to a horizontal displacement $\Delta$ at the top. The base moments developed is proportional to
(a) $1/h$
(b) $1/h^2$
(c) $1/h^3$
(d) None of the above

45. Influence line for redundant structures can be obtained by
(a) Castigliano's theorem
(b) Muller-Breslau principle
(c) Unit load theorem
(d) All the above

46. A cantilever beam of span $l$ subjected to a uniformly distributed load $w$ per unit length resting on a rigid prop at
the tip of the cantilever. The magnitude of the reaction at the prop is
(a) \( w/8 \)
(b) \( 2w/8 \)
(c) \( 3w/8 \)
(d) None of the above

47. The number of simultaneous equations to be solved in the slope
   deflection method is equal to
   (a) The degree of statical
       indeterminancy
   (b) The degree of kinematic
       indeterminancy
   (c) The number of joints in the
       structure
   (d) All the above

48. Which of the following statements is true with regard to the flexibility
    method of analysis?
   (a) The method is used to analyse
data determinate structures
   (b) The method is used only for
       manual analysis of inde terminate structures
   (c) The method is used for analysis
       of flexible structures
   (d) None of the above

49. Which of the following methods of
    structural analysis is a displacement
    method?
   (a) Moment distribution method
   (b) Coinman analogy method
   (c) Three moment method
   (d) None of the above

50. When a series of wheel loads crosses
    a simply supported girder, the
    maximum bending moment under
    any given wheel load occurs when
   (a) the centre of gravity of the load
       system is midway between the centre
       of span and wheel load under
       consideration
   (b) the tail of the load reaches the
       section
   (c) the load position should be such
       that the section divides it equally on
       both sides
   (d) the load position should be such
       that the section divides the load in the
       same ratio as it divides the span

51. Match List I with List II and select
    the correct answer using the codes given below the list
    
<table>
<thead>
<tr>
<th>List I</th>
<th>List II</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Doubly</td>
<td>1 Serviceability</td>
</tr>
<tr>
<td>reinforced</td>
<td></td>
</tr>
<tr>
<td>section</td>
<td></td>
</tr>
<tr>
<td>B Limit state</td>
<td>2 Durability</td>
</tr>
<tr>
<td>design</td>
<td></td>
</tr>
<tr>
<td>C Minimum</td>
<td>3 Reduction</td>
</tr>
<tr>
<td>cover</td>
<td>in sectional</td>
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<td></td>
<td>depth</td>
</tr>
<tr>
<td>D Span depth</td>
<td>4 Ultimate</td>
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<tr>
<td>ratio</td>
<td>movement</td>
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<tr>
<td></td>
<td>capacity</td>
</tr>
</tbody>
</table>

(Contd.)
52. As compared to an over reinforced section, an under reinforced section is preferred because:
   (a) More economical
   (b) Avoid sudden failure
   (c) Less steel is used
   (d) All of the above

53. The joint action of steel and concrete in an RCC section depends upon the
   (a) Bond between concrete and steel bars
   (b) Absence of corrosion of steel bars embedded in the concrete
   (b) Practically equal thermal expansion of both concrete and steel
   (e) All of the above

54. Analysis of reinforced concrete is done by
   (a) Straight line theory
   (b) Elastic theory
   (c) Ultimate load theory
   (d) All of the above

55. For a two way slab, main reinforcement is provided along the
   (a) Length of slab
   (b) Width of slab
   (c) Both length and width
   (d) All of the above

56. What is the minimum grade of concrete recommended in reinforced concrete work as per IS 456:2000?
   (a) M10
   (b) M15
   (c) M20
   (d) M25

57. What is the degree of workability of concrete measured in accordance with IS: 1199 for a slump of range 100 to 150?
   (a) Very low
   (b) Low
   (c) Medium
   (d) High

58. What is the basic values of span to effective depth ratios for simply supported T-beam for span up to 10m as per IS: 456?
   (a) 7
   (b) 20
   (c) 26
   (d) 31

59. What is the effective width of flange for isolated T-beam as per IS 456? (where b_e is the effective width of flange, l_o is the distance between points of zero moments in the beam, b_w is the breadth of the web, D_f is the thickness of flange and b is the actual width of flange)

   (Contd.)
(a) \[ \frac{1}{2\left(\frac{l_v}{b}\right)+4}\] + b_a
(b) \[ \frac{1}{2\left(\frac{l_v}{b}\right)+4}\]
(c) \[ 0.5\frac{1}{\left(\frac{l_v}{b}\right)+4}\] + b_a
(d) \[ 0.5\frac{1}{\left(\frac{l_v}{b}\right)+4}\]

60. A reinforced concrete beam is subjected to the 5KNm bending moment due to dead load and 25KNm bending moment due to live load. What should be the design bending moment for limit state of collapse?
(a) 30KNm
(b) 36KNm
(c) 45KNm
(d) 50KNm

61. In limit state design, what is the length of rectangular stress block in a stress block diagram? (where \( x_a \) is neutral axis depth)
(a) \( \frac{3}{7}x_a \)
(b) \( \frac{4}{7}x_a \)
(c) \( \frac{3}{4}x_a \)
(d) \( \frac{1}{2}x_a \)

62. The value of design bond stress in limit state method for bar in compression is increased by how much from the bar in tension?
(a) 15%
(b) 25%
(c) 40%
(d) 60%

63. The ultimate moment resisting capacity of a simply supported prestressed concrete beam using is obtained by using
(a) Force and moment equilibrium equations
(b) Stress - strain relationship of concrete and steel
(c) Moment equilibrium and compatibility condition
(d) Force equilibrium equation alone

64. In prestressing scheme, pre-stress load is transferred in a
(a) Single stage process
(b) Multi stage process
(c) Either single or multi stage process depending upon the magnitude of the load transfer
(d) The same manner as in post tensioning scheme

65. The propagation of a shear crack in a prestressed concrete member depends on
(a) Tensile reinforcement
(b) Compression reinforcement
(c) Shear reinforcement
(d) Shape of the cross-section of the beam

66. The magnitude of loss of prestress due to relaxation of stress is in the range of

(Contd.)
67. In an RCC beam side face reinforcement is provided if its depth exceeds
(a) 300 mm
(b) 500 mm
(c) 700 mm
(d) 750 mm

68. Lateral ties in RCC columns are provided to resist
(a) Bending moment
(b) Shear
(c) Buckling of longitudinal steel bars
(d) Both bending moment and shear

69. According to IS: 800, what is the maximum slenderness ratio of compression member carrying both dead and live load?
(a) 180
(b) 200
(c) 250
(d) 350

70. According to IS:800, what is the value of imperfection index ($\eta$) in the Merchant Rankine formula?
(a) 1.0
(b) 1.4
(c) 1.8
(d) 2.0

71. A strut is a structural member subjected to
(a) Tension in a direction parallel to its longitudinal axis
(b) Compression in a direction perpendicular to its longitudinal axis
(c) Compression in a direction parallel to its longitudinal axis
(d) Compression in a direction perpendicular to its longitudinal axis

72. The axial load which is sufficient to keep the column in a slight deflected shape is called
(a) Critical load
(b) Crippling load
(c) Buckling load
(d) All of the above

73. Angle of inclination of the lacing bar with longitudinal axis of the column should be between
(a) 20° to 30°
(b) 30° to 40°
(c) 40° to 70°
(d) 90°

74. Shear buckling of web in plate girder is prevented by using
(a) Vertical intermediate stiffener
(b) Horizontal stiffener

(Contd.)
(c) Bearing stiffener
(d) All of the above

75. Lacing provided for a compression member shall be designed to carry a transverse shear equal to
(a) 2.5% of axial force in member
(b) 5.0% of axial force in member
(c) 7.5% of axial force in member
(d) none of the above

76. In plastic analysis for flexure, which of the following pairs of shape of section and shape factor are correctly matched?
1. I...........................1.4
2. Square.....................1.8
3. Rectangle...............1.5
4. Circle.......................1.7
Select the correct answer using the codes given below
(a) 1, 2 and 3 are correct
(b) 3 and 4 are correct
(c) Only 3 is correct
(d) 1, 2, 3 and 4 are correct

77. As per BIS:800 the maximum bending moment for design of continuous purlins can be taken as
(a) WL/6
(b) WL/8
(c) WL/10
(c) WL/12

78. The economic spacing of roof truss depends upon the
(a) cost of purlins and cost of roof covering
(b) dead load and live load
(c) live load and cost of purlins
(d) live load and cost of roof covering

79. In a truss girder of a bridge, a diagonal consists of mild steel flat 400 ISF and carries a pull of 800 kN. If the gross diameter of the rivet is 26mm and power driven, then the number of rivets required in the splice is
(a) 6
(b) 7
(c) 8
(d) 9

80. Collapse load for a fixed beam with a central point load is
(a) 8M/L
(b) 16M/L
(c) 6M/L
(d) 4M/L

81. Which of the following mode of failure is taken care of in plastic design of a steel beam
(a) plastic material deformation throughout the beam
(b) hinge formation in the beam due to yield stress

(Contd.)
82. The permissible stresses for main structural steel members under dynamic loads should be increased by

(a) 11.11%
(b) 22.22%
(c) 33.33%
(d) None of the above

83. In the case of an axially loaded column machined for full bearing, the fastening connecting the column to the base plate in gusseted base are designed for

(a) 100% of the column load
(b) 50% of the column load
(c) 25% of the column load
(d) None of the above

84. If $P$ is the basic wind pressure for building with large opening design pressure on a wall is taken as

(a) 0.5$P$
(b) 0.7$P$
(c) 1.0$P$
(d) 1.2$P$

85. An equipment is available for ₹ 2,00,000.00. It has an estimated useful life of 5 years. By the double rate declining balance method of depreciation, the book value at the end of the second year will be

(a) ₹ 1,28,000
(b) ₹ 1,20,000
(c) ₹ 72,000
(d) ₹ 60,000

86. 6 cu.m RMC plant takes in 1875 kg of cement, 5120 kg of sand and 6060 kg of coarse aggregate along with 865 kg of water per batch. There is a reduction of 1.5% in volume in the fresh mixed wet concrete from the nominal volume. The unit weight of freshly mixed wet concrete will be

(a) 2400 kg/m³
(b) 2375 kg/m³
(c) 2355 kg/m³
(d) 2325 kg/m³

87. Self-lifting scraper

(a) reduce loss in power
(b) lower rolling resistance
(c) compromise between loading and hauling performance
(d) none of the above

88. In a project the contractor is paid on the basis of the running bill for a month. The rate contract for the concreting is ₹ 5000/m³ of concrete. The consumption of number of cement bags of weight 50 kg is 527. The mix proportion is 1:1.4:2.75 with W/C ratio as 0.52. The approximate billing amount for the month will be ₹
89. Batching refers to
   (a) controlling the total quantity at each batch
   (b) controlling the quantity of each material into each batch
   (c) water correction in batch
   (d) all of the above

90. It is desired to purchase four different types of construction equipment from three different manufacturers. The optimal order for the equipment and the minimal costs are to be determined. Most appropriate model for this purpose would be
   (a) Waiting line method
   (b) Inventory model
   (c) Transportation model
   (d) Assignment model

91. The optimistic, most likely duration and the pessimistic time estimate in a network are 4, 5 and 8 months respectively. The expected time is
   (a) 4 months
   (b) 5.33 months
   (c) 7.33 months
   (d) 8 months

92. The probability distribution taken to represent the completion time in PERT analysis is
   (a) Gamma distribution
   (b) Normal distribution
   (c) Beta distribution
   (d) All of the above

93. Cost of owning the equipment would include
   (a) cost of depreciation, maintenance, repair and fuel
   (b) cost of investment, wages of crew and fuel
   (c) cost of investment, major repairs and depreciation
   (d) all of the above

94. Sensitivity analysis is a study of
   (a) Comparison of profit and loss
   (b) Comparison of assets and liabilities
   (c) Change in output due to change in input
   (d) None of the above

95. Grader used mainly for
   (a) Trimming and finishing
   (b) Shaping and trimming
   (c) Finishing and shaping
   (d) Finishing, trimming and shaping

(Contd.)
96. The most suitable equipment for compacting cohesive soil is
   (a) Smooth-wheeled rollers
   (b) Vibratory rollers
   (c) Sheep foot rollers
   (d) Tampers

97. GANTT charts indicate
   (a) Comparision of actual progress with the schedule progress
   (b) Balance of work to be done
   (c) Progressive costs of project
   (d) Inventory costs

98. In resources levelling
   (a) Total duration of project is reduced
   (b) Total duration of project is increased
   (c) Uniform demand of resources is achieved
   (d) Cost of project is controlled

99. In time-cost optimisation of a project, crashing is done
   (a) On all the activities
   (b) On all the activities lying on the critical path
   (c) Only on activities lying on the critical path and having flatter cost slope
   (d) Only on activities lying on the critical path and having steeper cost slope

100. Consider the following statements
    The critical path in a network of a project.
    1. helps in planning efficient time schedule
    2. indicates shortest path in time
    3. helps in crashing the project of the statements
    (a) 1 is correct
    (b) 1 and 2 are correct
    (c) 1, 2 and 3 are correct
    (d) None of the above is correct