



QUESTION BOOKLET CIVIL ENGINEERING

PAPER - I (02)

Time Allowed : 2 Hours

Maximum Marks : 200

INSTRUCTIONS FOR CANDIDATES

1. Please do not open this Question Booklet until you are told to do so.
2. Candidate must fill up the necessary informations in the space provided on the OMR answer sheet before commencement of the examination.
3. Answer sheet will be processed by electronic device. Invalidation of answer sheet due to incomplete / incorrect filling of relevant circle of Roll No. and Question Booklet Series in the OMR answer sheet shall result in cancellation of candidature. Any deficiency in filling up OMR answer sheet will be the sole responsibility of the candidate.
4. An example is given below how to fill / mark (darken) Roll No. 41311706 and Question Booklet Series - B. Accordingly, you have to fill / mark (darken) the Roll No. and Question Booklet Series given to you in your OMR answer sheet.

EXAMPLE

Roll No.								Question Booklet Series
4	1	3	1	1	7	0	6	B
1	2	2	2	2	2	2	2	A ☐
2	2	2	2	2	2	2	2	B ☒
3	3	3	3	3	3	3	3	C ☐
4	4	4	4	4	4	4	4	D ☐
5	5	5	5	5	5	5	5	
6	6	6	6	6	6	6	6	
7	7	7	7	7	7	7	7	
8	8	8	8	8	8	8	8	
9	9	9	9	9	9	9	9	
0	0	0	0	0	0	0	0	



5. For marking the correct answer, darken one circle by **BLUE BALLPOINT PEN** only.
6. Please do not mark (darken) more than one circle. Darkening more than one circle against an answer will be treated as wrong answer.
7. Do not detach any leaf from this Question Booklet. After the examination, hand over the OMR answer sheet to the Room Invigilator. You are allowed to take the Question Booklet and carbon copy of the OMR answer sheet after examination is over.
8. Each question carries 2 marks. There is no negative marking for any wrong answer.
9. Possession and use of Calculator, Mobile Phone, Pager or any other electronic gadget is strictly prohibited in the Examination Hall.
10. Please abide by the instructions above and those given on the OMR answer sheet, failure to comply these instructions will be sole responsibility of the candidates.



02 - A

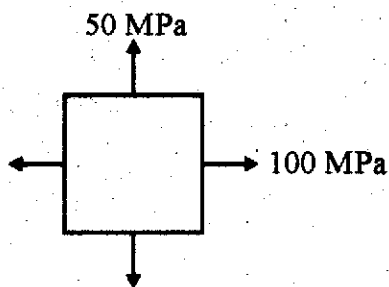
1. In an experiment it found that the bulk modulus of a material is equal to its shear modulus. The Poisson's ratio is

- (A) 0.125
- (B) 0.250
- (C) 0.375
- (D) 0.500

2. For a material having modulus of elasticity equal to 208 GPa and Poisson's ratio 0.3, what is the modulus of rigidity ?

- (A) 74.0 GPa
- (B) 80.0 GPa
- (C) 100.0 GPa
- (D) 128.5 GPa

3. For a state of stress shown in figure, normal stress acting on the plane of maximum shear stress is :



- (A) 25 MPa compression
- (B) 75 MPa compression
- (C) 25 MPa tension
- (D) 75 MPa tension

4. The radius of Mohr's circle of stress of a strained element is 20 N/mm² and minor principal tensile stress is 10 N/mm². The major principal stress is

- (A) 30 N/mm²
- (B) 50 N/mm²
- (C) 60 N/mm²
- (D) 100 N/mm²

5. A material of Young's modulus 'E' and Poisson's ratio ' μ ' is subjected to two principal stresses P_1 and P_2 at a point in two dimensional stress system. The strain energy per unit volume of the material is :

- (A) $\frac{1}{2E}(P_1^2 + P_2^2 - 2\mu P_1 P_2)$
- (B) $\frac{1}{2E}(P_1^2 + P_2^2 + 2\mu P_1 P_2)$
- (C) $\frac{1}{2E}(P_1^2 - P_2^2 + 2\mu P_1 P_2)$
- (D) $\frac{1}{2E}(P_1^2 - P_2^2 - 2\mu P_1 P_2)$

6. In the Mohr's circle of strains, radius of the Mohr's circle gives the

- (A) Minimum value of normal strain
- (B) Maximum value of normal strain
- (C) Maximum value of shear strain
- (D) Half of the value of shear strain

7. Which of the following theories of failure is most appropriate for brittle material ?
- (A) Maximum principal strain theory
 - (B) Maximum principal stress theory
 - (C) Maximum shear stress theory
 - (D) Maximum strain energy theory
8. All the failure theories give nearly the same result
- (A) when one of the principal stresses at a point is large in comparison to other.
 - (B) when shear stresses act.
 - (C) when both the principal stresses are numerically equal.
 - (D) for all situations of stress.
9. A steel plate is bent into a circular arc of radius 10 m. If the plate section be 120 mm wide and 20 mm thick with E as 200 GPa, then the maximum bending stress induced is
- (A) 210 N/mm^2
 - (B) 205 N/mm^2
 - (C) 200 N/mm^2
 - (D) 195 N/mm^2
10. A symmetrical I-section is subjected to shear force. The shear stress induced across the section is maximum at which location ?
- (A) Extreme fibres
 - (B) At the bottom of flanges in flanges
 - (C) At the bottom of flanges in web
 - (D) At the neutral axis
11. A rectangular beam of width 100 mm is subjected to a maximum shear force of 60 kN. The corresponding shear stress in the cross-section is 4 N/mm^2 . The depth of the beam should be
- (A) 200 mm
 - (B) 150 mm
 - (C) 100 mm
 - (D) 225 mm
12. The 'plane section remains plane' assumption in bending theory implies
- (A) Strain profile is linear
 - (B) Stress profile is linear
 - (C) Both profiles are linear
 - (D) Shear deformation is neglected
13. The shear stress at the neutral axis in a beam of triangular cross-section with a base of 40 mm and height 20 mm, subjected to a shear force of 3 kN is
- (A) 3 MPa
 - (B) 6 MPa
 - (C) 10 MPa
 - (D) 20 MPa

14. A long shaft of diameter 'd' is subjected to twisting moment 'T' at its ends. The maximum normal stress acting at its cross-section is equal to
- (A) zero
 (B) $\frac{16 T}{\pi d^3}$
 (C) $\frac{32 T}{\pi d^3}$
 (D) $\frac{64 T}{\pi d^3}$
15. The maximum and minimum shear stress in a hollow circular shaft of outer diameter 20 mm and thickness 2 mm, subjected to a torque of 92.7 N-m will be
- (A) 59 MPa and 47.2 MPa
 (B) 100 MPa and 80 MPa
 (C) 118 MPa and 160 MPa
 (D) 200 MPa and 160 MPa
16. If the diameter of shaft is subjected to torque alone is doubled, then the horse power 'P' can be increased to
- (A) 16 P
 (B) 8 P
 (C) 4 P
 (D) 2 P
17. Which structure is more stable ?
- (A) Determinate
 (B) Indeterminate
 (C) Both (A) and (B)
 (D) None of the above
18. The strain energy of a structure due to bending is given by
- (A) $2 \int \frac{M^2 dx}{2 EI}$
 (B) $\frac{1}{3} \int \frac{M^2 dx}{EI}$
 (C) $\frac{1}{2} \int \frac{M^2 dx}{EI}$
 (D) $\int \frac{M^2 dx}{EI}$
19. The distribution factor for a rigid joint always
- (A) 1
 (B) 0.5
 (C) 1.5
 (D) 0
20. A fixed beam AB carries a point load 'W' at centre C. If support B have upward by 'Δ', then
- (A) Moment at A increase, Moment at B increase
 (B) Moment at A decrease, Moment at B increase
 (C) Moment at A increase, Moment at B decrease
 (D) Moment at A decrease, Moment at B decrease

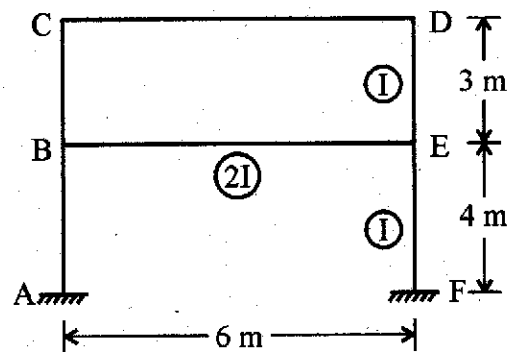
21. The rotation at a point in a real beam equals to _____ in a conjugate beam.

- (A) Translation
- (B) Twisting moment
- (C) Shear force
- (D) Bending moment

22. In a continuous beam ABC, support A is fixed and supports B and C are simply supported. A uniformly distributed load of 'w' per meter run is applied over the span AB and span BC is subjected to a point load 'W' at mid span. If the beam has uniform cross-section but differs in span lengths for AB and BC, the conditions to be used for the analysis of continuous beam by the slope deflection method are

- (A) $\theta_A = 0, M_{BA} = M_{BC}, \theta_C = 0$
- (B) $\theta_A = 0, M_{BA} + M_{BC} = 0, \theta_C = 0$
- (C) $\theta_A = 0, M_{BA} + M_{BC} = 0, M_{CB} = 0$
- (D) $\theta_A = 0, M_{BA} = M_{BC}, M_{CB} = 0$

23. A frame to be analysed by moment distribution as shown in figure. The distribution factors for members EB, ED and EF will be respectively



- (A) $\frac{2}{9}, \frac{4}{9}, \frac{1}{3}$
- (B) $\frac{8}{13}, \frac{3}{13}, \frac{4}{13}$
- (C) $\frac{3}{10}, \frac{4}{10}, \frac{3}{10}$
- (D) $\frac{4}{11}, \frac{4}{11}, \frac{3}{11}$

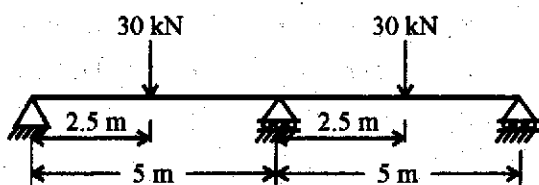
24. If an Internal stress component like shear force, bending moment or reaction component is allowed to act through a small distance thereby causing deformation of the structure, the curve of the deformed shape represents to some scale, the influence line diagram for that stress or the reaction component. The above statement is known as :

- (A) Macaulay's theorem
- (B) Muller Breaslau principle
- (C) Castigliano's theorem
- (D) Maxwell's theorem

25. The moment which makes all the fibers at the section to yield is known as
- (A) Flexural rigidity
 - (B) Moment of resistance
 - (C) Plastic moment capacity
 - (D) Yield moment

26. The shape factor of a I section is
- (A) 1.2
 - (B) 1.5
 - (C) 2.0
 - (D) None of the above

27. Determine the load factor and factor of safety of a two span continuous beam as shown in figure. The plastic moment and elastic moment of the beam are 150 kN-m and 100 kN-m respectively.



- (A) 6.0 and 2.0
- (B) 4.0 and 2.35
- (C) 6.0 and 4.0
- (D) 4.0 and 4.35

28. Which expression represents shape factor ?
- (A) $\frac{(MOB)_p}{(MOB)_e}$
 - (B) Z_p/Z_e
 - (C) Both (A) and (B)
 - (D) None of the above

29. For a linear elastic structural system, minimization of potential energy yields
- (A) Compatibility conditions
 - (B) Constitutive relations
 - (C) Equilibrium equations
 - (D) Strain displacement relations

30. The order of flexibility matrix of a structure is
- (A) Equal to the number of redundant forces
 - (B) More than the number of redundant forces
 - (C) Less than the number of redundant forces
 - (D) Equal to the number of redundant forces plus three

31. Stiffness method of structural analysis starts with
- (A) Force-deformation relations
 - (B) Equilibrium condition
 - (C) Compatible deformation
 - (D) Equilibrium state of internal stress components

32. Which of the following methods is not classified as a force method ?
- (A) Theorem of three moments
 - (B) Moment distribution method
 - (C) The method of consistent deformation
 - (D) Castigliano's theorem
33. In the slope deflection equations, deformations are considered to be caused by
- (A) Shear forces and bending moments only
 - (B) Axial forces and bending moments only
 - (C) Axial forces, shear forces and bending moments
 - (D) Bending moments only
34. The moment distribution method in structural analysis falls in the category of
- (A) Displacement method
 - (B) Force method
 - (C) Flexibility method
 - (D) First-order approximate method
35. By which one of the following methods, an approximate quick solution possible for frames subjected to transverse loads ?
- (A) By cantilever or portal method
 - (B) By strain energy method
 - (C) By moment distribution method
 - (D) By matrix method
36. For a fixed beam AB of length L , the depth of beam upto mid-span is 'd' from left end and $0.5d$ for rest $L/2$. What is the carry over factor from A to B while using moment distribution method for the analysis ?
- (A) 0.5
 - (B) 1.0
 - (C) < 0.5
 - (D) > 0.5
37. ISHT stands for
- (A) Indian Standard Heavy weight Tee Bars
 - (B) Indian Standard High tensile Tee Bars
 - (C) Indian Standard Slit Tee Bars from H-Sections
 - (D) Indian Standard Hollow Tee Bars
38. An ISMB 500 is used as a beam in a multi-storey building construction. From the structural design point of view it can be considered to be laterally restrained when,
- (A) Tension flange is laterally restrained.
 - (B) Compression flange is laterally restrained.
 - (C) Web is adequately stiffened.
 - (D) The conditions in (A) and (C) are met.

39. The common assumption that, all rivets share equally a non-eccentric load is valid at a load
- Below the working load
 - Equal the working load
 - Above the working load
 - Equal to the failure load
40. The upper yield point in the stress strain curve in structural steel can be avoided by
- Cold working
 - Hot working
 - Quenching
 - Galvanizing
41. In the fillet weld the weakest section is the
- Smaller side of the fillet
 - Throat of the fillet
 - Side perpendicular to the force
 - Side parallel to the force
42. In a double-riveted double cover butt joint, the strength of the joint per pitch length in shearing the rivets is 'n' times the shear strength of one rivet in single shear, where 'n' is equal to
- 1
 - 2
 - 3
 - 4
43. Maximum size of fillet weld for a square plate of square edge is
- 1.5 mm less than the thickness of the plate
 - One half of the thickness of the plate
 - Equal to the thickness of the plate
 - 1.5 mm more than the thickness of the plate
44. A steel beam supporting loads from the floor slab as well as from wall is termed as
- Stringer beam
 - Lintel beam
 - Spandrel beam
 - Header beam
45. Generally, the maximum deflection/span ratio of a steel member should not exceed
- 1/750
 - 1/500
 - 1/325
 - 1/250
46. As per IS-800, the maximum allowable slenderness ratio of compression members carrying forces resulting from dead load and superimposed load is
- 180
 - 250
 - 300
 - 400

47. Effective length of a rafter member between two nodes at a distance 'L' perpendicular to the plane of the truss is

- (A) 2.00 L
- (B) 0.85 L
- (C) 1.5 L
- (D) 1.0 L

48. Consider the following statements regarding the roofing of a industrial structure :

1. The conoidal shell is preferable to northlight steel trussed roof.
2. The warehouse flat slab construction is not suitable.
3. Loads other than self weight has insignificant effect on the design.
4. Consideration of corrosive environment cannot be ignored as it affects the durability .

Which statements are correct ?

- (A) 1, 2, 3 and 4
- (B) 2, 3 and 4
- (C) 1 and 2
- (D) 3 and 4

49. Purlins are provided in industrial buildings to carry dead loads, live loads and wind loads. As per IS Code, what are they assumed to be ?

- (A) Simply supported
- (B) Cantilever
- (C) Continuous
- (D) Fixed

50. A building with a gabled roof will experience pressure on its leeward slope which is

- (A) always positive.
- (B) always negative.
- (C) sometimes positive and otherwise negative.
- (D) zero.

51. The effective length of an angle member in a riveted truss is equal to

- (A) l
- (B) $0.85 l$
- (C) $0.65 l$
- (D) $0.5 l$

Where l is the centre to centre distance between the joints.

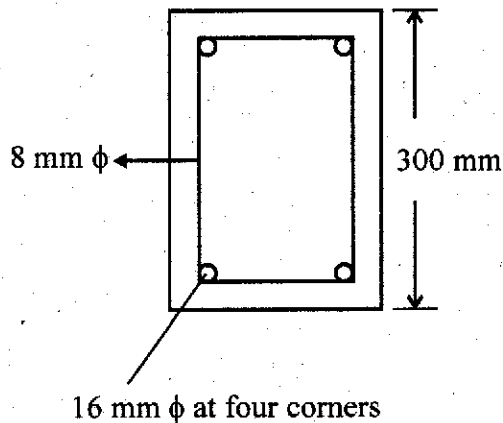
52. IS 456-2000 considers concrete has reached its limit state of collapse when the strain is

- (A) 0.0015
- (B) 0.0020
- (C) 0.0030
- (D) 0.0035

53. The centroid of a compression block representing stress in concrete at limit state, the distance being measured from extreme compression edge is

- (A) $0.36 \chi_u$
- (B) $0.42 \chi_u$
- (C) $0.48 \chi_u$
- (D) $0.53 \chi_u$

54. Find the effective depth of the beam as shown in figure. Clear cover is 15 mm.



- (A) 277 mm
(B) 275 mm
(C) 273 mm
(D) 269 mm
55. As per IS 456, in a column the maximum distance between two longitudinal bars should not greater than
- (A) 200 mm
(B) 300 mm
(C) 250 mm
(D) 350 mm
56. If standard deviation is 4 N/mm², the mean strength of M20 concrete should be
- (A) 16 N/mm²
(B) 20 N/mm²
(C) 24 N/mm²
(D) 26.4 N/mm²

57. The maximum area of tensile reinforcement to be used in a beam is to be restricted to

- (A) $0.04 \times$ gross area of the section
(B) $0.04 \times$ effective area of the section
(C) $0.057 \times$ gross area of the section
(D) $0.057 \times$ effective area of the section

58. The location of neutral axis in RC T-beam

- (A) Lies in flange always
(B) Depends on flange depth and total depth
(C) Lies in the web always
(D) Lies at the junction of flange and web

59. What is the effective length of the column when effectively restrained against translation at both the ends but restrained against rotation at one end only ?

- (A) 0.707 L
(B) 0.8 L
(C) 0.65 L
(D) 0.5 L

60. The depth of an isolated footing is generally governed by

- (A) bending moment consideration
(B) development length consideration
(C) shear consideration
(D) All of the above

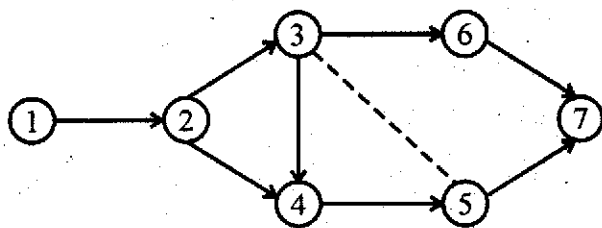
61. In a RC beam main reinforcement consists of 16 mm bars and coarse aggregate size used is 20 mm. The horizontal distance between two parallel reinforcing bars should not be less than
- 16 mm
 - 20 mm
 - 21 mm
 - 25 mm
62. In limit state approach, the spacing of main reinforcement controls primarily
- Collapse
 - Cracking
 - Deflection
 - Durability
63. What should be the minimum grade of plain and reinforced concretes respectively provided for construction in coastal areas ?
- M20 and M30
 - M25 and M30
 - M20 and M25
 - None of the above
64. As per IS : 456, the minimum thickness provided in flat slab shall not be less than
- 100 mm
 - 125 mm
 - 150 mm
 - 200 mm
65. Which of the following states falls under limit state of serviceability as per IS 456 : 2000 ?
- Stability under load
 - Loss of equilibrium of a structure
 - Floor vibration
 - Formation of mechanism
66. Modulus of elasticity of concrete is increased with
- Higher water-cement ratio
 - Shorter curing period
 - Lesser vibration
 - Increase in age
67. The loss of prestress due to stress relaxation in steel depends on
- Amount of shrinkage in concrete
 - Initial prestress in steel
 - Coefficient of friction in between steel and concrete
 - Amount of elongation in steel
68. Which one of the following is not a post-tensioning method ?
- Freyssinet system
 - Gifford Udall system
 - Long Line method
 - Lee-Macall system

69. The loss of prestress with time at constant strain is called
- Shrinkage
 - Relaxation
 - Creep
 - All of the above
70. The main reinforcements of a RC slab consists of 10 mm bars at 100 mm spacing. If it is designed to replace the 10 mm bars by 12 mm bars, then the spacing of 12 mm bars should be
- 120 mm
 - 140 mm
 - 144 mm
 - 160 mm
71. A reinforced concrete slab is 75 mm thick. The maximum size of reinforcement bar that can be used is
- 12 mm diameter
 - 10 mm diameter
 - 8 mm diameter
 - 6 mm diameter
72. An expansion joint is provided when the length of a concrete structure exceeds
- 5 m
 - 25 m
 - 45 m
 - 85 m
73. Lateral truss in RC columns are provided to resist
- Bending moment
 - Shear
 - Buckling of longitudinal bars
 - Both bending moment and shear
74. An axially loaded column is of 300 mm $\times$ 300 mm size. What is the minimum eccentricity of the axial load for the column of effective length 3 m ?
- 0
 - 10 mm
 - 16 mm
 - 20 mm
75. Mortars used for brick masonry shall conform to
- IS 2116
 - IS 456
 - IS 1332
 - IS 2250
76. Which one of the following is not a factor affecting strength a brick masonry wall ?
- Size and location of door in a wall
 - Positioning of cross wall
 - Type of roof the wall bears and its connection
 - Type of plastering on the wall

77. Which of the following is a weakness in Bar chart ?

- (A) Independencies of activities
- (B) Project progress
- (C) Uncertainties
- (D) All of the above

78. In the network shown below, the activity 4-5 can be started only when



- (A) Activity 3-4 completed
- (B) Activity 2-4 completed
- (C) Activity 2-3 completed
- (D) Activity 2-4 and 3-4 both completed

79. Which of the following is not a PERT event ?

- (A) Site investigation started
- (B) Sessional work completed
- (C) Bus started from Hyderabad
- (D) Class is being attended

80. The normal duration and normal cost of an activity are 10 days and ₹ 350 respectively. The cost slope is ₹ 75 per day. If the crash duration is 8 days, then what is the crash cost of the activity ?

- (A) ₹ 400
- (B) ₹ 500
- (C) ₹ 600
- (D) None of the above

81. In the time-cost optimization, using CPM method for network analysis, the crashing of the activities along the critical path is done starting with the activity having

- (A) Longest duration
- (B) Highest cost slope
- (C) Least cost slope
- (D) Shortest duration

82. For completion of a project, the critical path of the network represents

- (A) Minimum time
- (B) Maximum time
- (C) Maximum cost
- (D) Minimum cost

83. For a given activity, the optimistic time, pessimistic time and the most probable estimates are 5, 17 and 8 days respectively, the expected time is

- (A) 8 days
- (B) 9 days
- (C) 10 days
- (D) 15 days

84. Which method of application of preservative is suitable for moist timber ?

- (A) Pressure application
- (B) Brushing and spraying
- (C) Soaking
- (D) Hot and cold tank treatment

85. According to relevant IS Code, the weight of the timber is to be reckoned at moisture content of

- (A) zero
- (B) 4%
- (C) 8%
- (D) 12%

86. Seasoning of timber is required to

- (A) Softening the timber
- (B) Harden the timber
- (C) Straighten the timber
- (D) Remove sap from the timber

87. The modulus of elasticity of timber is about

- (A) $0.5 \text{ to } 1.0 \times 10^4 \text{ N/mm}^2$
- (B) $1.0 \text{ to } 1.5 \times 10^4 \text{ N/mm}^2$
- (C) $1.5 \text{ to } 2.0 \times 10^4 \text{ N/mm}^2$
- (D) $2.0 \text{ to } 2.58 \times 10^4 \text{ N/mm}^2$

88. Consider the following methods of preservation of timber :

1. Dipping
2. Brushing
3. Pressure impregnation

The correct sequence in decreasing order of the effectiveness of these methods of preservation is

- (A) 1, 2, 3
- (B) 2, 1, 3
- (C) 3, 1, 2
- (D) 3, 2, 1

89. For complete hydration of cement, the water cement ratio needed is :

- (A) Less than 0.25
- (B) More than 0.25 but less than 0.35
- (C) More than 0.35 but less than 0.45
- (D) More than 0.45 but less than 0.60

90. A cement bag contains 0.035 m^3 of cement by volume. How many bags will one ton of cement comprise ?

- (A) 16
- (B) 17
- (C) 18
- (D) 20

91. The temperature range in a cement kiln is :

- (A) 500°C to 1000°C
- (B) 1000°C to 1200°C
- (C) 1300°C to 1500°C
- (D) 1600°C to 2000°C

92. The fineness of cement is tested by
 (A) Air content method
 (B) Air permeability method
 (C) Le-Chatelier apparatus
 (D) Vicats apparatus
93. For marine works best suited cement is :
 (A) Low heat portland cement
 (B) Rapid hardening cement
 (C) Ordinary portland cement
 (D) Blast furnace slag cement
94. The specific gravity of commonly available ordinary portland cement is
 (A) 4.92
 (B) 3.15
 (C) 2.05
 (D) 1.83
95. The most important purpose of frog in a brick is to
 (A) Emboss the manufacturer's name
 (B) Reduce the weight of the brick
 (C) Formed the keyed joint between brick and mortar
 (D) Improve insulation by providing hallows
96. Refractory bricks resist
 (A) High temperature
 (B) Chemical action
 (C) Dampness
 (D) All of the above
97. The minimum compressive strength for first-class brick should be
 (A) 5 N/mm²
 (B) 7.5 N/mm²
 (C) 9 N/mm²
 (D) 10 N/mm²
98. The nominal size of standard modular brick is
 (A) 25 cm × 13 cm × 8 cm
 (B) 25 cm × 10 cm × 8 cm
 (C) 20 cm × 10 cm × 10 cm
 (D) 20 cm × 15 cm × 10 cm
99. Maximum slenderness ratio for load bearing masonry wall, built in cement mortar as per IS Code shall not exceed :
 (A) 13
 (B) 20
 (C) 27
 (D) 30
100. Given that an element in a body of homogeneous isotropic material subjected to plane stresses, ϵ_x , ϵ_y and ϵ_z are normal strains in x, y and z directions respectively and 'μ' is the Poisson's ratio, the magnitude of unit volume change of the element is given by
 (A) $\epsilon_x + \epsilon_y + \epsilon_z$
 (B) $\epsilon_x + \mu (\epsilon_y + \epsilon_z)$
 (C) $\mu (\epsilon_x + \epsilon_y + \epsilon_z)$
 (D) $\frac{1}{\epsilon_x} + \frac{1}{\epsilon_y} + \frac{1}{\epsilon_z}$